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Experimental Work in School Geography

L. J. JAY

THE GEOGRAPHER who is concerned with transmitting part of his knowledge to children in school, and concurrently with fostering in them certain desirable attitudes, must necessarily devote considerable thought to the presentation of his material. Unlike his counterpart in a university, the teacher in school has to study methods almost as much as subject-matter, and for this reason he is usually interested in the experiences of other teachers which may assist him in his task. One of the leading functions of the Geographical Association since its inception has been to serve as a medium for the exchange of this expertise.

Articles on this theme in *Geography* are supplemented from time to time by those mentioned in the classified lists of papers in other periodicals which are sent to the Association and thus become available to users of the Association's Library. These valuable lists, however, inevitably omit a few articles which are published in educational journals not primarily concerned with geography, and which are not received by the Association. It would therefore seem desirable to draw the attention of members to these scattered contributions which are not readily accessible to teachers in school.

The following abstracts, given in chronological order of publication, relate to articles which have appeared in British journals or bulletins of education during the last fifteen years, i.e. since 1945.

The Blank Map Test in Geography Examinations by John I. Moncrieff[1]

This is a summary of a thesis approved as part-requirement for the degree of B.Ed. at Glasgow University in 1949. The aim of the investigation was to analyse the effectiveness of the blank outline map test as used in many geography examinations in Scottish senior secondary schools, with particular regard for three points: (*a*) does the blank map really test locational knowledge, (*b*) does success in this test depend on other abilities, and if so, what are they, (*c*) does the answering of a blank map test involve some specific ability to any considerable extent?

The most serious criticism of this type of test is that the marking is not objective, since examiners tend to disagree over the margin of error allowed for a "correct" location. It is also alleged that this test involves abilities beyond mere locational knowledge. As a preliminary to the investigation, therefore, the opinions of about thirty geography teachers were sought on this subject. In their replies the factors most commonly quoted as bearing on the blank map test were: general and non-verbal intelligence, knowledge of geographical locations, map-reading ability, visual memory, the ability to draw and to see spatial relationships. Some teachers felt that a further special ability was involved.

➤ Mr. Jay, Honorary Librarian of the Association, is a lecturer in the Department of Education, University of Sheffield.

A battery of eight tests was then prepared to examine the seven factors listed above together with a blank map test of the type normally used in schools. To test locational knowledge, a map of North America indicated towns by dots, and physical features; all these items were numbered on the map, and children had to identify the names of forty of them. To test map-reading ability, 35 items comprising simple recall and multiple-choice type questions were compiled from the school atlas used by the pupils.

The tests were completed by 97 boys and 101 girls of average age 13½, all following an academic course and occupying the top classes of their form in one senior secondary school. In every test the Standard Deviation of the boys' score was greater than that of the girls, suggesting that in these tests there was a greater range and variability among the boys. In comparing the various tests, there was a high degree of correlation between the blank map test and the locations test, the latter being entirely objective. These two tests were shown to a number of geography teachers, who considered them to be of equal difficulty, yet the mean score for the blank map test was higher than that for the locations test (65·8 per cent against 61·5 per cent). This is surprising in view of the popular belief that it is easier to identify a dot on a map which represents a town, than it is to place a dot correctly to locate a town on a blank map.

The correlations with tests other than knowledge of location were statistically significant but low, showing only a slight relationship, but there was no significant correlation between the blank map test and the test of spatial relationships. Further analysis of the results showed that there was no large specific factor present in the tests; the general factor represented a combination of map-abilities and general intelligence, whilst there was also a group factor of ability to handle designs.

School and Neighbourhood by various authors[2]

This was the title of a special number of *Studies in Education* in 1951 which was devoted to the theme of social studies in the area of the Hull Institute. About one-third of the seventeen essays describe the historical and geographical background of Hull and the East Riding. The remaining articles, mostly by practising teachers, deal with aspects of social studies in schools of various grades and settings. The titles indicate their scope: Geography through Local Studies, Bird Watching for Schools, Farm and School Relationships, a Junior School approach to Social Studies, etc. They succeed in presenting the rich variety of environmental studies available to teachers in this area, and offer pointers to further experiment, although the foreword makes it clear that in publishing these reports the Hull Institute did not intend to advance the claims of social studies.

[This symposium appeared at a time when there was lively discussion in educational circles of the merits and evils of social studies in schools. Whether this term connoted a newcomer to the curriculum, or a closer integration of certain established subjects, or whether it was regarded as an approach, an attitude of mind, its ramparts were being assailed by the big guns of the subject specialists. S. W. Wooldridge delivered a broadside in 1949 in his address to the Geographical Association "On Taking the Ge- out of Geography". In the following year the Education Committee of the Royal Geographical Society expressed alarm at the spread of "this

amorphous hotch-potch" of geography, history and civics, whilst about the same time an International Seminar of UNESCO held in Montreal made declarations no less hostile. Soon afterwards the historians brought up their artillery to bear on the same target. For these and other reasons, it seems likely that social studies in school lost some ground during the 'fifties. Nevertheless the geography teacher who believes in the value of field work done by his pupils, and who encourages them to make an ordered examination of the school locality, will endorse much that is contained in this collection of essays by enthusiasts.]

Local Studies in Practice edited by A. E. Tubbs, Lecturer in the Department of Education, University of Birmingham[3]

A course on Local Studies, directed by A. E. Tubbs, formed part of the programme at a residential summer school organized by the University of Birmingham Institute of Education, held at Malvern in 1951.[4] As a sequel to the work accomplished during that fortnight, practising teachers were invited to describe any studies which they had organized, and this article contains three such reports.

Mrs. O'Shaughnessy outlines the work achieved in a village in south Warwickshire, where she taught the 19 senior pupils, aged 11–15, in a small all-age rural school containing 56 children. With two exceptions, all her pupils had an Intelligence Quotient below 100. She undertook the survey of "Our Village" to give them an awareness of the conditions under which they were living, which might serve as a basis for later observations, as adults, of the conditions in the world at large.

The children were allowed to choose a topic from a prepared list, and they were permitted to work alone, with a friend, or in a group. Hints were given on the art of making brief notes in the field, sketching, and expanding these notes upon returning to the school. The ultimate objective of each unit was to display the information in an attractive and instructive poster. Reference books, paste, paper, scissors and notebooks were provided, and the teacher was available for consultation at all times. As each child or group of children completed one topic they selected another, thus enabling all to work at their own speeds, irrespective of age or ability. The project occupied a month of the time-table, although arithmetic, literature, music, P.E. and gardening lessons were retained.

P. H. Keyte gave an account of a local survey of the Wrekin area made by the pupils of a large secondary modern school at Madeley in Shropshire. Sixteen topics for investigation were tabled, and at the end of the survey the staff organized an exhibition, lasting a week, which was opened to parents and the public.

The topic entitled "Farming in the district" was studied by a third-year class one hour per week for about 30 weeks. Each child had its own folder and gathered information individually after school hours. Discussions held in lesson-time studied the answers to questionnaires used by the pupils and ensured an efficient circulation of information. The public exhibition held at the conclusion of the project was regarded as an essential part of the scheme.

The third survey, described by R. G. Dawes, was carried out by the pupils of a large secondary modern boys' school near the centre of

Birmingham. The school, occupying one of the poorer districts of the city, is organized mainly on a class-teacher basis, with specialization only in subjects such as music, art and P.E. A class of 34 A-stream boys made a survey of the district adjacent to the school during the last term of their leaving year, their aim being to find out what the area was like before it had become built up, and why it had become industrialized.

A map of the local electoral district was duplicated in four sections which were subsequently fitted together and mounted on large sheets of paper. The class divided into eight groups, each group being allocated one-half of one section. Houses, factories and public buildings were first plotted on the map before the history of the streets and buildings was investigated. Visits to the Central Reference Library indicated the material available, and each group selected topics for study. The time-table was re-arranged, and by using the periods normally taken by history, geography, English and individual study lessons, two afternoons per week were allotted to this work.

Each boy was given a notebook and any necessary map sections. The groups drew up lists of questions each week, and these were discussed with the teacher before the answers were sought from local industrialists, clergymen, and librarians. Once a week each group reported on its activities to the rest of the class and discussions were held to polish up the wording of the reports. The finished maps and reports were collected in a large loose-leaf folio which could be displayed, sheet by sheet, on tables around the school hall. Each class in the school was allowed one lesson in which to inspect the completed survey, and at a later date it was shown to parents on an open day.

As the editor observes, although these reports were prepared independently there is much common ground between them. The pupils enjoyed the novelty of work which allowed the individual to proceed at his own pace, whilst it fostered co-operation between children of varying ages and abilities. Success in each case hinged on careful organization and preparation, together with a willingness to re-arrange the normal routine. Much of the work was done voluntarily after school had ended—a measure of the enthusiasm aroused—and the participants discovered how to find things out for themselves, exercising self-discipline and experiencing pride in achievement. These were amongst the benefits resulting from local surveys which were in part historical, partly geographical.

Testing Geography at the Ordinary Level of the General Certificate of Education by John C. Daniels, University of Nottingham Institute of Education.[5]

It is remarkable that the introduction and widespread adoption during the last 30 years of "objective" tests in procedures for the allocation of children to secondary schools at the age of eleven has not been matched by any comparable change in the form of questions used in Certificate Examinations for pupils aged about sixteen, although in the United States the use of objective tests has spread beyond the primary school level into colleges and universities. So far as the testing of geography at the Ordinary level of G.C.E. is concerned, there are three types of question which are currently favoured:

(1) Objective-type questions, which it is claimed are more reliable to mark than the essay-type of question.

(2) The interpretation of geographical data in the shape of maps, diagrams and statistics.
(3) Reasoned accounts in essay form.

A conference of geography teachers from grammar schools in the East Midlands requested the Institute of Education at the University of Nottingham in 1951 to organize an inquiry which would examine these varied viewpoints, and this article summarizes the results of the ensuing investigation, which had two main aims:

(1) Of the three types of examination question mentioned above, which is the most reliable and valid?
(2) What would be the best weighting of marks to give to each type of question, if all three types were included in a single geography examination?

The investigation was conducted among 720 fourth-form pupils drawn from 15 different schools. A group of geography teachers, in co-operation with Mr. Daniels, decided upon the major topics likely to be common to the majority of fourth-form geography courses, and then constructed three tests, each designed to last approximately one hour.

Test A—This consisted of three sorts of objective-type questions: recall (e.g. "In which season of the year does rain mainly fall in the interior of continents?"); multiple-choice (e.g. "Where is twilight the longest—at the Equator, the Tropic of Cancer, Nottingham, Aberdeen?"); yes-or-no. (e.g. "Is it true that on the earth's surface land is a greater area than ocean?")

Test B—This comprised questions on two world maps of different projections, interpretations of statistical diagrams dealing with climate, and the drawing of diagrams to illustrate various geographical phenomena.

Test C—Here pupils had to answer three out of eight essay-type questions, chosen from typical O-level G.C.E. papers.

Some time before these tests were administered, teachers in the 15 schools provided estimates of their pupils' geographical ability, expressed as percentages with a mean roughly of 50. All relevant information, e.g. classwork, homework, notebooks, weekly tests and terminal examinations, were used in compiling these estimates, which served as a criterion against which the validity of the test results could be measured.

Tests A and B were marked according to a strict scheme, and safeguards were taken to ensure a fair marking of the essay-type questions in Test C.

Analysis of the results showed that all three tests had a reasonably high reliability, even Test C, which is the type sometimes regarded as least reliable. In order to give the best correlation with teachers' estimates, the necessary weighting given to each test brought out clearly the dominant part played by essay-type questions in the battery, although the author concedes that this interpretation of the results may reflect a bias on the part of the teachers in favour of the essay type of answer. A comparison made of teachers' estimates in four of the schools revealed some variations of opinion concerning the relative importance of the three types of geographical ability.

A *Critical Note* on Daniel's article by S. S. Dunn of the Australian Council for Educational Research appeared a year later.[6] Dunn criticizes the inclusion of items involving the interpretation of maps, diagrams and

statistics, on the grounds that this tests only one element of geographical ability, whereas the objective and essay-type questions were presumably intended to cover all aspects. He comments on the construction and composition of the items in Test A, and on the teachers' part in the experiment. In his reply, Daniels refers to the difficulties likely to arise when an article is unable to give full details of an investigation, points out that many of Dunn's recommendations were, in fact, followed when the tests were prepared, and concludes by stressing that he did not wish to discourage the use of objective tests in all subjects and situations.

Group Work in the Teaching of Geography by H. J. Hallworth, Lecturer in Education, University of Birmingham.[7]

This experiment was conducted in a co-educational grammar school of about 650 pupils, and the full report of it formed part of a thesis submitted by the author for the degree of M.A. (Education) in the University of London in 1951. His aim was to try and assess the effect of group work, as compared with the usual class methods, upon the attainment of pupils in geography, and their attitude towards this subject.

Children entering the school were allocated at random to one of four forms. At the end of the second year the pupils highest on the examination lists went into an Arts or a Science form, the remainder forming two parallel non-specialist forms. Taking part in this experiment were one form from each of the first and second years; one non-specialist third form (here called 3n); and two non-specialist fourth forms, one of which served as an experimental group (4ex), the other as a control group (4con). The last two were comparable in mental ability.

In all of these forms normal class-teaching methods were used during the autumn and spring terms. These methods continued in 4con during the summer term, whilst the remainder were taught by group methods of working, utilizing earlier experience of such methods.

The pupils formed themselves into groups, each of not more than four individuals, and generally each group remained unchanged throughout the summer term. Almost invariably, girls chose to work with girls, and boys with boys. The syllabus for each form was divided into sections, each of which was given a time limit of not more than three weeks. One or two class lessons introduced each section, accompanied by a map summary and possibly by brief notes; thereafter each group was largely free to organize its own work, with the proviso that every member must help with both maps and notes. Within one form, each group covered the same section of the syllabus at the same time, and produced for the teacher's inspection a notebook which included maps, diagrams, pictures and written work. Each pupil made in his exercise book a summary of the work in the group notebook, and a short test was given on each section of the syllabus as it was completed.

All the forms involved were taught by one geography master who, if he had any preference at all, was probably prejudiced originally in favour of his usual class methods of working. During group work the teacher provided reference books and generally assisted them to organize their activities.

Two attainment tests dealing with the geography of Central and Southern Europe (the areas studied during the summer term) were constructed and given to forms 4ex and 4con in March and July, i.e. before and after the

experimental period of group work. Fifty items based on the syllabus were used to make two tests, one which assessed knowledge of geographical facts and another which concerned ability to understand relationships. Some of the questions were in the form of maps, graphs and diagrams.

In both of these tests the mean scores for each form were higher in July than in March, as might have been expected, but whereas the mean scores for 4con were higher than those for 4ex in March, the results for 4ex, using group methods, were slightly better than for 4con in July, although the gains were not so much greater that the difference could not be attributed to chance alone.

In addition to these attainment tests the pupils in all forms involved were given a questionnaire in March and July, designed to reveal their attitude towards geography, and with the exception of 4con, they were asked to comment on their preferences for group or individual work. This inquiry revealed a more positive attitude towards geography in July than in March in all forms except form 2, and appeared to confirm the belief, held by many teachers, that attitudes towards school subjects tend to become fixed early in the course, so that significant improvements in attitude resulting from experimental methods are most marked in the younger forms. With the striking exception of form 2, written comments revealed a strong preference for group work; it was more interesting, was learnt more easily, allowed discussion, and was more friendly. The exceptional position taken by form 2 is explained as a consequence of the school organization and its "social climate". The pupils in this form knew that they would be graded in July according to their academic success during the year, and that their position on this grading would affect the remainder of their school careers. Almost without exception they wished to do as well as possible, and this anxiety produced complaints that group working might affect adversely an individual's examination result.

A Comparison between Sound and Silent Films in Teaching by Gordon Q. Craig, Sheffield Education Authority.[8]

The full report of the experiment which is summarized in this article was submitted in part requirement for the Advanced Certificate in Education awarded by the University of Sheffield Institute of Education in 1956. Although the findings were based on general science lessons the investigation has been included in this group of abstracts because the methods employed are highly relevant to the use of films in the teaching of geography.

Most pre-war attempts to compare the merits of sound and silent films in teaching were based on the subjective opinions of teachers and pupils, and no results of statistical significance were obtained. Since 1945 the dominance of sound films in entertainment has led to a decline in the production of silent films, yet no properly conducted research has established the superiority of the sound over the silent film in classroom teaching. Most educational sound films are now available in mute copies, i.e. with no sound-tracks, for use on silent projectors, and the author investigated whether a teacher can use a 16 mm. sound film with greater effect by using the mute copy and supplying his own commentary.

Two groups of children took part in this experiment, 124 first-year pupils in a four-stream secondary modern school in May 1954, and 136 first-year children in the same school in May 1955. These groups were closely similar

in age, intelligence, attainment and socio-economic background; their mean Quotients in the Common Entrance Examination were about 99 for Intelligence and English and approximately 105 for Arithmetic.

Six short science films, each with a running time of between 8 and 11 minutes, were selected for the test. Their titles, which are listed in the E.F.V.A. catalogue, are:—Making glass for houses: a rock pool in school: light, first principles: common cross spider: how television works: ants.

The children were shown each of these six films once only, one film per week over six weeks. Each group saw three sound and three silent films. Immediately after seeing each film, and again four weeks later, the children answered a test paper. All the testing took place during the normal science lessons of each class. Beyond introducing the title and providing a suitable atmosphere for the classroom the sound films were shown by the author without comment. The same teacher introduced the silent films in a similar manner: the commentary was unscripted, and the matter was adapted to the level of the class according to their ability and experience.

The test results, both of immediate recall and delayed recall, showed significantly higher mean scores in favour of the silent versions of each film. The mean score of the delayed recall tests on the silent films exceeded the mean score of the immediate recall tests on the sound films, which suggests that the children who saw the silent versions retained more information over four weeks than was remembered for one lesson by those who saw the sound films. The mean scores of those children who had an I.Q. of 80 or under were lower than the mean scores for the full range of children, as might have been expected, but here again the silent films appear to have been remembered more effectively than the sound versions, judging from the test scores.

The children were at first surprised, when told the results of the tests, but in discussion they gave several reasons to explain the success of the silent films. It was difficult to watch the film and listen to the sound at the same time, the teacher spoke more slowly than the sound commentary, the actual voice of the teacher was more compelling and easier to follow than the sound track. Several backward children admitted that they could not follow much of the sound commentary, so they tended to ignore it.

It seems reasonable to conclude that in the case of direct teaching films (not films used for background or illustrative purposes), the teacher can achieve better results by using a muted version of a sound film, adding his own commentary. In this way he can adapt the film to suit his own purposes, alter the commentary to meet the needs of the class, and make use of films that would otherwise be unsuitable.

The Place of Maps in the Teaching of Geography by H. M. Johnson.[9]

This is a brief outline of an extended study carried out by Miss Johnson as part of her work for the Diploma in Secondary Education in the Institute at Nottingham in 1958.

She criticizes the assumption that maps will have the same use and value for children in school as they have for adult geographers. This assumption, she asserts, has given maps an artificial place in school geography; map-reading has become an aim in itself instead of the means towards an end, and map-work now forms a separate part of the geography syllabus.

Miss Johnson examines critically Fairgrieve's three stages of map-reading, which he compared with stages in learning to read a written language. Learning to speak, recognizing the written equivalents of the spoken word, and learning to read by understanding the sense of written words in association, are matched according to Fairgrieve, by finding one's way about the land, learning map symbols of real landmarks, and map-reading. She criticizes the artificial division thus placed between learning map symbols in isolation before learning how to read a map, since this separation hinders true perception. Her own experiences as a teacher are drawn upon to discuss the teaching of scale and direction.

The article unfortunately is not long enough to give sufficient detail of the experimental work which Miss Johnson conducted into the teaching of map-reading and interpretation. Nevertheless she deals with a fundamental skill in the school geography course, and for that reason alone one may hope that her findings will eventually be published at greater length.

Four of the above abstracts are compiled from articles which in themselves are condensed accounts of investigations conducted by practising teachers for a higher degree or diploma. Nevertheless it is hoped that enough detail has been retained to indicate the scope of each inquiry, and the journals from which these abstracts are taken may be consulted in the Library of any Institute of Education.

It is a matter for regret that most researches of this nature, which utilize practical experience of schools and children, become known only to a few people, for much of this experimental work rarely appears in print, although it is clear from the lists prepared by Mrs. Blackwell that many such investigations have been successfully completed in recent decades.[10] One could wish that a greater proportion of these studies concerned with geography in schools, might be submitted—with appropriate reductions in length—for publication in the pages of this journal, to interest a wider circle of readers.

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Reference to several of these researches is made in a useful article by N. V. Scarfe, "The teaching of geography in schools: a review of British research," *Geography*, vol. xxxiv, June 1949, pp. 57–65.

This Changing World

POPULATION CHANGES IN NORTHERN IRELAND

No detailed maps exist which record population distributions and changes in Northern Ireland for the past thirty years, although Mogey has studied the period 1920–37, and the Census Returns analyse the changes in statistical form for each county. Detailed mapping of the distributions of population and of the inter-censal population changes draws attention to those areas in which changes have been greatest, and suggests further lines of inquiry for their explanation. The district electoral divisions of Northern Ireland provide a close network of about a thousand units, suitable as a base for constructing detailed maps.

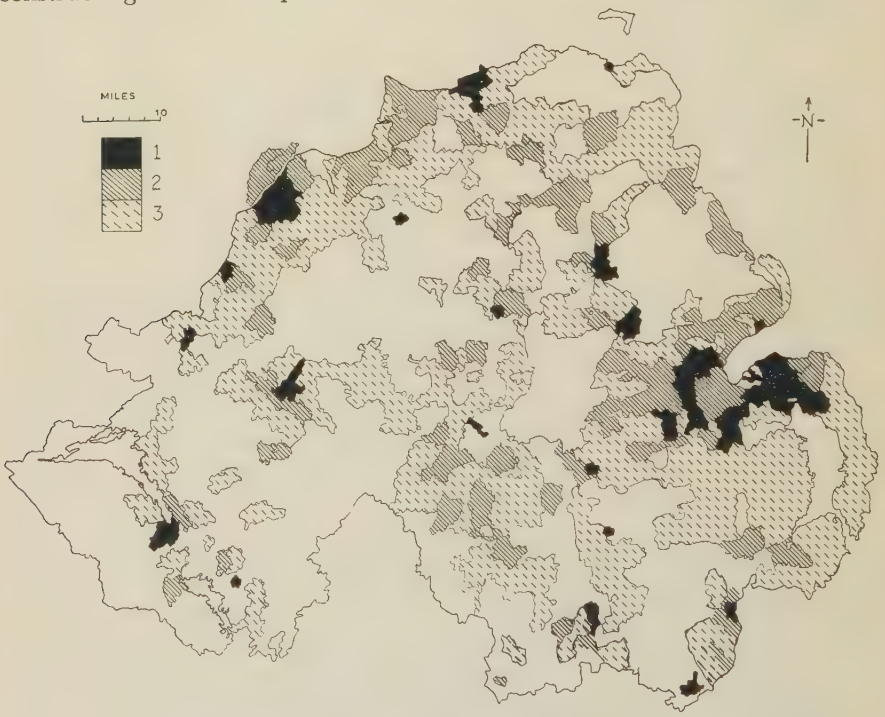

Fig. 1.—Population increase in Northern Ireland 1921–51. 1. Continuous increase beyond the median. 2. Continuous variable increase. 3. Increase 1937–51 only.

Census data exist for the years 1926, 1937 and 1951. The percentage changes in population in the periods of 1926–37 and 1937–51 were determined for each District Electoral Division, except for the cities of Belfast and Londonderry which were not subdivided, but were each treated as single units. To produce an objective classification of the resulting percentage changes, the changes for all district electoral divisions were arrayed into percentage increases and decreases, making separate arrays for the two inter-censal periods. These arrays were divided into quartiles, and the quartile divisions were used for mapping.

Four initial maps were thus produced showing the increases and decreases for each inter-censal period. From these, Fig. 1, showing the general pattern of population increases for the whole period 1926–51 was then prepared, summarizing the data of the previous maps. The increase of population shown in this period is of three sorts:

1. Continuous increase above the median in each inter-censal period.
2. Continuous increase but not necessarily above the median in either or both periods ("continuous variable increase" on map).
3. Increase only in the period 1937–51.

This last class is valuable as its distribution emphasizes the general pattern linking scattered areas of change. A similar method was employed for Fig. 2, which shows the general pattern of population decreases.

Extensive fieldwork is necessary to interpret such detailed distributions, but certain trends of change are suggested on the maps themselves.

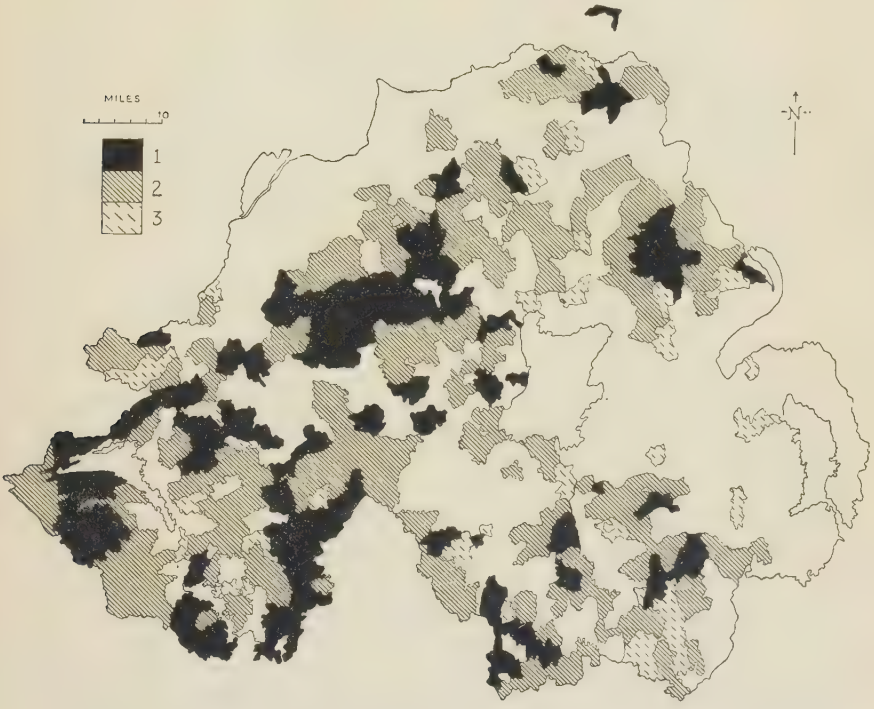

Fig. 2.—Population decrease in Northern Ireland 1921–51. 1. Continuous decrease beyond the median. 2. Continuous variable decrease. 3. Decrease 1937–51 only.

Fig. 1 shows outstanding regions of population increase round Belfast and Londonderry. The small increases inside Belfast municipal boundary contrast with the zone of high increases just outside, which forms part of a continuous region of increase extending from Lough Neagh to Island Magee, and from Belfast Lough to Lecale. The largest areas of increase lie around Belfast and extend to include the whole of the Ards peninsula. These are largely areas of recent increase, having decreased during 1926–37. This reversal of trends is particularly well marked in the peninsulas of

Newtownards and Island Magee. The whole area, which is bounded to the north and south by the Antrim Plateau and the Mournes respectively, falls into regions, roughly concentric about Belfast:

1. The urban area of Belfast, constantly increasing from 1926–51.
2. The zone just outside the city boundary, of constant high increase.
3. A broken zone of variable high increase.
4. An outer zone of recent increase, with a marked exaggeration south and west of Belfast.

This region is mainly lowland, classified on the land utilization maps of 1938–39 as arable and grassland, except for a small area northwest of Belfast city. The Lagan corridor from Belfast towards Lurgan appears as a focus for heavy population increases, while the heavy ring of increase round the municipal boundary largely expresses urban sprawl. The overall pattern suggests an incipient conurbation of Belfast, Lisburn, Larne and Newtownards.

The Londonderry area of population increase forms a strip extending along the Foyle valley and the north coast from Strabane to Ballycastle. The Foyle valley itself is divided by the political frontier, and therefore part of this pattern is incomplete. Zoning about Derry city appears absent; the heterogeneous nature of the increases seems to result partly from the inclusion of smaller urban centres such as Limavady and Portrush within the main pattern. The whole of the region included is mainly lowland, and is bordered on the south by the Sperrins.

The remaining areas of increase are scattered and cannot be explained from the map. Some of them include areas of upland such as the area between Omagh and Cookstown. Other anomalies, such as the inclusion of the main Mourne peaks in areas of heavy population increase, reflect the ungeographical delimitation of the District Electoral Divisions.

Towns appear as centres of population increase almost everywhere, while Omagh, Strabane and Ballymena also show as exceptional foci for surrounding areas of rural increase.

The Sperrins west of Lough Neagh, as well as most of Fermanagh, show on Fig. 2 as regions of heaviest population decrease, although this area of decrease shows no simple correlation with relief. These two areas are separated by a belt of population increase extending from Pomeroy to Armagh.

The southern part of the Antrim Plateau shows zones of heavy decrease broken by the Braid valley. There is also an area of decrease surrounding Ballycastle, but these two regions are separated by a belt of increase running right across the plateau. Increases are shown in the upper Bush Valley, most of the valley of Sixmilewater, and all the glens except Glenarm. However, the lower Bush valley shows decreases, and the valley of Sixmilewater is straddled by a belt of decreases. This county shows that the physical boundaries and the boundaries of population change do not necessarily correspond.

In County Down a very varied area of population decrease extends inland in a general northerly direction across the western Mournes, and spreads to include the valleys of the upper Lagan and the upper Bann. Within this area the towns of Banbridge and Dromore appear as islands of population increase.

The pattern of decrease in Fermanagh and County Armagh is intricate, varied and obscured by the political frontier. However, except in the lowlands of County Armagh to the southwest of Lough Neagh, and in the neighbourhood of Enniskillen, the area has generally decreased in population almost everywhere.

The maps illustrate very clearly the effects of urbanization. The heavy concentrations of population increase on Fig. 1 indicate the positions of nearly every large town in Northern Ireland, while the most extensive areas of depopulation are the most rural counties—Londonderry, Fermanagh and Tyrone. Moreover, towns themselves maintain their increases even in areas of rural population decrease. Banbridge, Dromore and Dungiven are examples.

Mogey lists the causes of rural population decrease as continuous emigration, low rural living standards, low rural wages and lack of work. The maps suggest that inaccessibility is also an important influence, as illustrated perhaps by the heavy decreases of population on Rathlin Island, and in southwest Fermanagh. Inaccessibility is contributed to in a more general way also by the centralization of transport and other social services on Belfast. Professor Isles, in *An Economic Survey of Northern Ireland* (H.M.S.O., 1957), emphasizes the divorce of industry from agriculture in Northern Ireland, which is probably a major catalyst of change. He further suggests that increasing mechanization may well reduce the number of employed farm labourers, thus speeding rural depopulation.

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EAST GERMANY'S NEW INDUSTRIAL PLAN

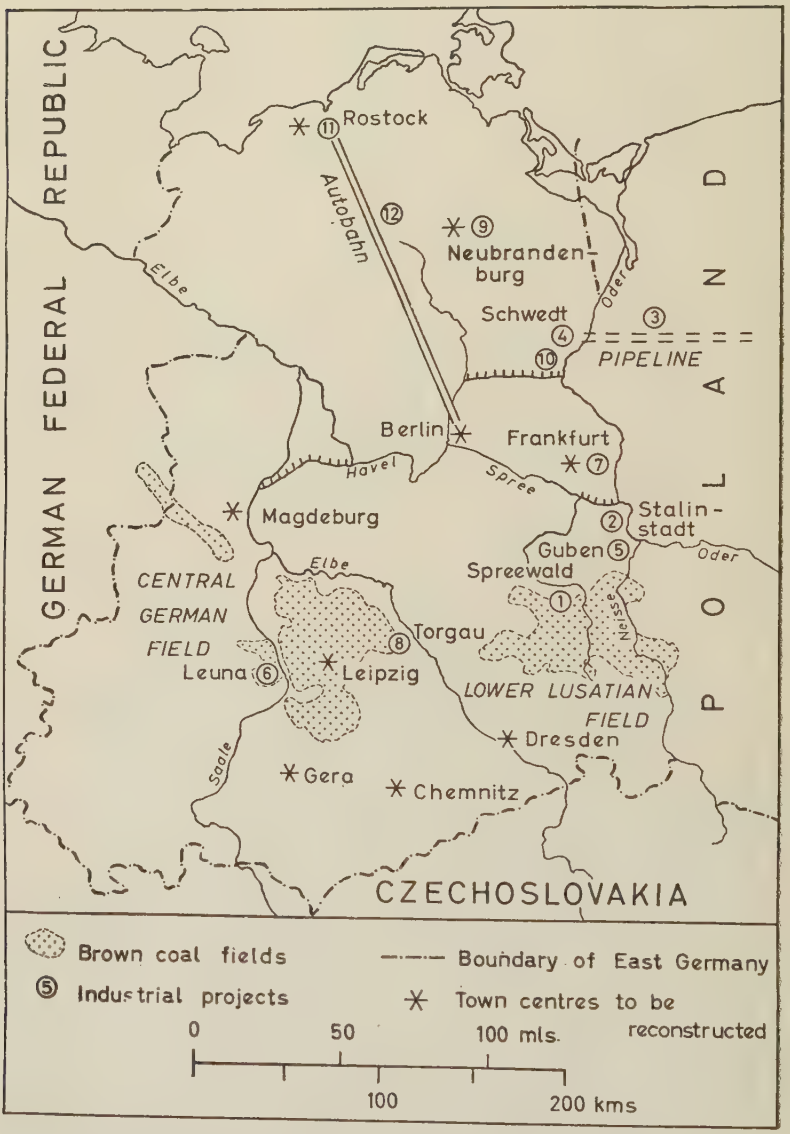
A new course for East German industry is mapped out by the Seven-Year Plan (1958–65), belated details of which appeared in the East German press towards the end of 1959. The plan evidently supersedes the Second Five-Year Plan, which was to have run to the end of 1960. It predicts an increase of industrial output of the order of 9–10 per cent a year.

The achievement of this high rate of increase will be difficult because of East Germany's chronic labour shortage, caused partly by the ever-increasing demands from an expanding industry, partly by the continuing flight of people to the west. Consequently there is marked emphasis in the plan on increasing the productivity of labour which will be done through automation, and also by specializing in those branches of industry in which East Germany has a particular advantage.

This trend towards specialization is clearly seen in the new industrial projects. Further attempts to give East Germany its own heavy industrial base have been dropped. Admittedly the Stalinstadt plant on the Oder is at last to be completed by the addition of steel furnaces and rolling mills, but it has been made quite clear that this is solely to secure the advantages of integrated production. No more blast furnaces producing high-cost iron from Ukrainian ore and Polish coke are to be built in the foreseeable future.

Similarly the elaborate plant under construction at Schwarze-Pumpe, in Lower Lusatia, for producing metallurgical coke and chemicals from brown

coal, seems to have been allowed to drop out of the limelight. Schwarze-Pumpe appears in the new Plan as a producer of electricity, gas and briquettes; the fact that the whole aim of the plant was to turn these briquettes into coke is not mentioned (see "This Changing World",



New Industrial Projects under the Seven-Year Plan

1. Lübbenau and Vetschau power stations. 2. Steel furnaces and rolling mills at Stalinstadt. 3. Oil pipeline from the U.S.S.R. 4. Schwedt oil refinery. 5. Guben synthetic fibre plant. 6. Leuna II, petrochemicals plant. The nearby Buna synthetic rubber plant at Schkopau is also to be extended. 7. Frankfurt-on-Oder semi-conductor plant. 8. Torgau plate glass and safety glass works. 9. Three fibreglass plants in Neubrandenburg District. 10. Schwedt paper and board mills. 11. Completion of Rostock harbour extension. 12. *Autobahn* Berlin-Rostock.

Geography, vol. xli, 1956, pp. 192–5). The front-page scheme under the present plan is to use brown coal, not as a chemical raw material, which was the intention a few years ago, but for burning in the boilers of the giant Lübbenau and Vetschau power stations in the Spreewald, stations with a planned joint capacity of 2300 MW by 1965. The construction of the Lübbenau plant is now well advanced.

The movement away from expensive self-sufficiency, and towards the economic integration of the communist countries can only benefit East Germany, which lacks most raw materials. The key to the new situation is undoubtedly the economic progress of the Soviet Union, which is now able to supply the other communist states with their requirements of basic materials. Under what is claimed to be the biggest trade agreement ever to be signed between any two states, the Soviet Union will send to East Germany during the period 1960–65 some 32 million tons of coal, 12 million tons of iron ore, 8 million tons of coke, 15 million tons of rolled steel, as well as pig iron, non-ferrous metals, petroleum, timber, pulp, cotton, grain and other materials.

In return, East Germany will concentrate on the further development of the chemical and engineering industries which it inherited on partition. It will send to the Soviet Union both complex industrial equipment and also consumer goods. Items to be delivered include long-distance railway coaches, refrigerated waggons, ships, complete cement works, equipment for the food-processing industries and, above all, chemical products.

East Germany is to follow West Germany in turning over from home coal to imported oil as a basis for future developments in the chemical industry. An extension of the great Leuna chemical plant on the Central German brown coal field will use petroleum products to make polythene and the basic material for synthetic fibres. To meet the rising needs for oil a new refinery is being built at Schwedt, on the Oder, northeast of Berlin (see "This Changing World", *Geography*, vol. xlv, 1960, pp. 110). A capacity of two million tons by 1963, and five million by 1965, is reported. Schwedt, unknown until now, seems likely to become an important centre of industry; it is to have a big paper and board mill, and there is some talk of the eventual addition of a petrochemicals plant to the refinery.

The selection of Schwedt points to another characteristic of the new Plan, the obvious preference, in building new plants, for sites in formerly undeveloped rural areas in the north and east of the country (see *The Times Review of Industry*, July 1959, p. 84). Another big change is the development of Rostock as East Germany's main port. Before the war, the area which is now East Germany was served by the ports of Hamburg and Stettin, which are now in West German and Polish hands respectively. For some years now work has been in progress on excavating a series of dock basins from the mud of the east bank of the Warnow estuary below Rostock, in order to provide a deep-water port (see *Annales de Géographie*, vol. 69, 1960, pp. 15–21). The mouth of the estuary has now been dredged to a depth of 34 feet. Towards the end of the Plan period it is intended to link the port more firmly with the main East German industrial centres by building a motorway 170 miles long to link with the existing *Autobahn* network at Berlin. It is intended, no doubt, that the road will also help in the industrialization of the rather remote countryside between Berlin and the coast.

The Plan also provides for an attack on the acute housing shortage, and the reconstruction of the centres of Berlin, Dresden, and other cities, large parts of which have stood empty for 15 years or more. Willingness to divert resources to urban reconstruction on this scale presumably indicates a growing confidence in the vitality of the East German economy.

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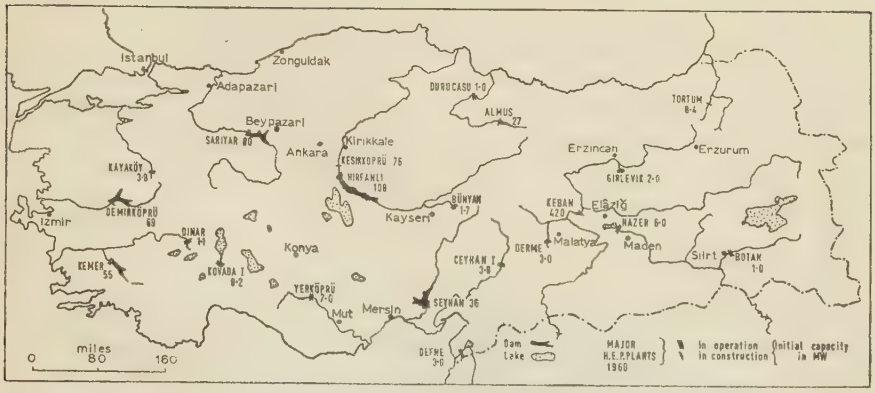
HYDRO-ELECTRIC SCHEMES IN TURKEY

Between 1950 and 1960 hydro-electric power supply in Turkey has grown from 4 per cent to 30 per cent of the country's electricity capacity. Turkey's potential hydro-electric resources are estimated at $90{,}000 \times 10^6$ kWh; however 0·5 per cent of this potential is used at present and the per capita consumption of electricity is extremely low—96 kWh, compared with 1870 kWh in Britain—a condition which reflects the present immaturity of industrialization and the backwardness of village life. The foremost consideration in giving priority to H.E.P. development is the relief of the older thermal power plants dependent on coal from Zonguldak, limited in reserves and expensive to transport, and on lignite, widely occurring but of low quality.

Bearing in mind that major H.E.P.-producing countries like Norway and Switzerland are mountainous and have humid climates, it may seem astounding that the Central Anatolian plateau, with its basins of interior drainage and largely semi-arid climate, should possess large hydro-electric power resources. Relatively low, seasonal precipitation varies from 300 mm. in the Konya basin to over 500 mm. in the eastern Anatolian plateau; annual fluctuations are very marked. On the margin of the plateau, however, in the north, south and east, mountain ranges receive a heavier rainfall, as do the higher ridges and volcanic massifs of the plateau interior. Part of the precipitation is stored in snowcaps on the mountains and underground in volcanic and limestone rocks, later to be released in due season to contribute to the river systems of Inner Anatolia. Dams are usually constructed at locations where the rivers debouch from the mountains on to the plain of the interior or in gorges in volcanic rocks. Where earthquakes may be expected, or where it may be more economical, dams are built of rock and earth fill instead of solid concrete, while smaller schemes often utilize the direct flow from streams or canals without using dams.

The most important plants are the Sariyar and Hirfanli barrages recently completed to west and east of Ankara. At Sariyar barrage, completed in 1957 on the Sarkaya river, a 106 metre-high curved concrete dam has been constructed in a deeply incised gorge in crystalline limestone. Special treatment of the bed of the river and reservoir has been necessary to check excessive loss of water by seepage along joints and to provide a sound foundation for the dam. The present lake stretches back 40 km. towards Beypazari. The steep slopes above the water margins have been devastated for centuries, but now, with the prohibition of grazing in the vicinity of the barrage, shrub vegetation may develop and ultimately there may be regeneration of forest in the area. The head of water is slightly increased by the location of the power house on the downstream side of a spur below the dam. The initial capacity of the plant, 80 MW, is to be increased to 160 MW and power



is transmitted by overhead lines east to Ankara and Kirikkale on the Kizil irmak and west to Adapazari and Istanbul.

The setting and construction of the Hirfanli scheme are entirely different. The dam, built in a gorge of the Kizil irmak river where it breaks through a gabbro outcrop of the surrounding massif, is constructed of earth and rock rubble piled against a core of impervious clay to a height of 82 metres, a structure better able than concrete to withstand the earthquakes to which this region is subject. The barrage was officially opened in January 1960 and now has a capacity of 108 MW (to be increased to 144 MW); the plant is connected to the north-western grid. The great lake of Hirfanli extends 75 km to the southeast of the dam, its clear blue waters an incredible sight in the most arid part of central Anatolia, in contrast with the Great Salt lake some 30 km to the west across a narrow divide of hills.

Kizil irmak means "red river", and though the lake water is still clear and blue, silting at the head of the lake presents a problem, as elsewhere in Turkey; the capacity of the Çubuk barrage near Ankara is believed to have been reduced by one-third in 30 years through silt deposit. The estimated life of the Hirfanli lake before silting may render it ineffective may be 100 to 150 years—but could be less. This process could be slowed down by prohibition of grazing in the area and by reafforestation and regeneration of the steppe vegetation, but such national as well as local measures prove both expensive and difficult to plan for the whole country. Dredging would be even more costly than the building of new barrages and already on the Sarkaya and Kizil irmak rivers sites for future dams have been selected.

The northern edge of the Taurus massif provides much scope for hydro-electric development though at present small plants of only local importance are in existence. Most of the existing dams—for instance the newly completed Ayranci barrage—serve mainly to control floods and provide irrigation water. Bünyan, Dinar and Yerköprü are important and characteristic of H.E.P. plants using direct river flow. Bünyan plant (1·7 MW capacity), at the foot of an escarpment near Kayseri, is near a small town with a large Sümer-Bank cloth factory and a domestic knotted carpet industry. The Dinar plant (1·1 MW capacity) is built just below the point where the river Menderes issues from the Taurus mountains as a strong karst spring; its

power production is consumed by the towns of the Lake district, of which Isparta, with rose-oil factories and home carpet industry, is the most important. The Yerköprü plant, completed in 1958 on the Göksu river, south of Konya, has an initial capacity of 7 MW which can be increased to 10·6 MW. Power from this plant not only supplies Konya but is also used in the reclamation of semi-arid or marshy areas at the northern foot of the Taurus. Further south lies another district where power from Yerköprü could be used for irrigation—the area around the small town of Mut in an enclave in the Göksu basin, a backward, underdeveloped but potentially productive agricultural district, only recently made accessible by a new road between Mersin and Konya.

Eastern Anatolia has large potential H.E.P. resources, but most existing schemes are small and of only local importance. A few more important schemes may be mentioned. Plant near Elâziğ (initial capacity 6 MW, final capacity 12 MW) utilizes water brought by canal from the tectonic lake Hazer, lying some 30 km to the south in a high basin. Besides supplying Elâziğ, a new town, the plant also transmits power to the Maden mining district, with its copper refinery. North of Erzerum and supplying that town, a plant on the Tortum waterfalls has a capacity of 8·4 MW (later 16·8 MW). Although Erzerum has not yet recovered from the destruction caused by an earthquake, it is the military and development centre for the Turkish eastern provinces and has a new university. Other H.E.P. plants of regional importance are on the headstreams and tributaries of the Euphrates and Tigris, supplying Erzincan, Malatya and Siirt.

The most interesting and important future developments in Eastern Turkey are to be expected in the large-scale utilization of the Euphrates and Tigris waters. The Keban dam planned on the Euphrates with an initial capacity of 420 MW (later 980 MW) has yet to be started; indeed at present the sparse population and low rate of development in the east do not seem to justify investments on such a large scale. However, the development of the Eastern provinces is not merely an economic issue; in many ways it is of vital importance to Turkey. Power plants and dammed lakes could become the nuclei for intensive colonization of these inner basins, allowing the exploitation of rich mineral deposits as yet untouched, the development of agriculture through irrigation and eventually metallurgical, chemical and fertilizer industrial development. Town and village life would be made more attractive to settlers and officials. Elâziğ, Erzerum, Malatya and Maden are such initial development centres already receiving power supplies from recently installed plants. From such centres the psychological barrier may be gradually broken down between the dreary, winter-cold Eastern Provinces, still awaiting full colonization, and the more advanced parts of Turkey. This alien feeling—akin maybe to the attitude of the Romans towards the inhospitable British highlands—jeopardizes the full economic, cultural and political incorporation and development of the valuable eastern territories.

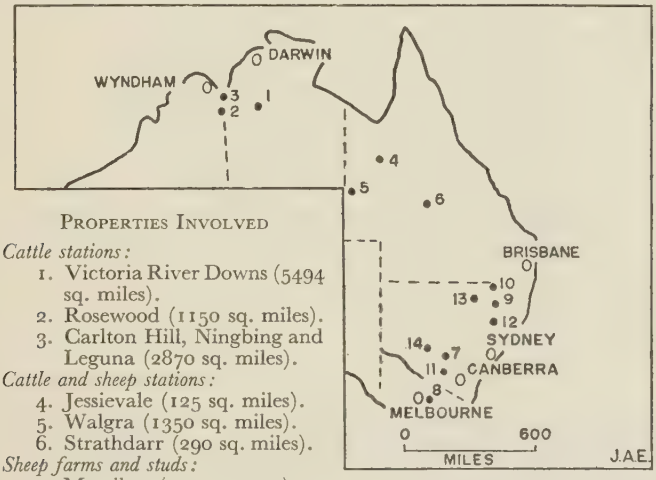
The Turkish programme for H.E.P. development may be too ambitious considering the country's economic state. The maximum capacity of the existing thermal and hydro plants already exceeds the country's current needs; and while consumer industries are slowly developing, dammed lakes are silting up. Although the dams permit regulation of river flow and control

of flooding and erosion, their use for irrigation purposes is also slow in developing, unfortunate in a country where agricultural yields in dry-farming are precarious and low and where practically no fodder is produced. A less direct result of the development of artificial lakes may be an amelioration of local climates in Inner Anatolia (though no data are yet available) on the analogy of observations in the Taurus Lake district, where trees like cedars grow near the lakes and fruit-growing is favoured, contrasted with the lakeless and arid intra-montane basins and valleys.

Ankara LIESA V. NESTMANN

AUSTRALIA'S BIGGEST PASTORAL LAND DEAL

On 5th May, 1960 the Australian press announced the biggest pastoral land deal in Australian history—one of special interest to the geographer because of the promise which it seems to hold for the opening of a new chapter in the development of the tropical north of the continent.



PROPERTIES INVOLVED

Cattle stations:

1. Victoria River Downs (5494 sq. miles).
2. Rosewood (1150 sq. miles).
3. Carlton Hill, Ningbing and Leguna (2870 sq. miles).

Cattle and sheep stations:

4. Jessievale (125 sq. miles).
5. Walgra (1350 sq. miles).
6. Strathdarr (290 sq. miles).

Sheep farms and studs:

7. Merribee (22,000 acres).
8. Barragunda (3500 acres).
9. Glenroy (4500 acres).
10. Ballarang (30,000 acres) and Curragunda (23,000 acres).
11. Clifton (15,000 acres).
12. Colly Creek (5500 acres).
13. Moomin Plains (26,000 acres).
14. Rudds Point and Llandillo (21,600 acres).

In the deal (carried out by the "share-options" technique), conservatively estimated at £A5.6 million, fourteen properties changed hands from William L. Buckland and Associated Companies (Melbourne) to the L. J. Hooker Investment Corporation (Sydney and Canberra), the latter being a body which until now has confined its activities to big city developments like hotel, office and home construction, and life assurance interests. The properties range from large cattle stations in northern Australia and cattle and sheep stations in western Queensland, to sheep farms and studs in New South Wales and Victoria, and they include a large block of flats in Sydney's fashionable residential Pott's Point.

Responsibility for the pastoral interests of the Hooker Group will be shared by the Hooker Pastoral Co. Pty. Ltd (with control of nine of the newly acquired properties) and Australian Wool Brokers (with control of the remainder, all of which are in New South Wales and Victoria).

From the geographer's viewpoint the most significant feature of the land deal is the effect which it may have on the future development of the beef cattle industry in tropical Australia. In this connection it is worth noting that the Pastoral Division of the Corporation will be managed from Canberra, which is becoming increasingly important as the centre from which all decisions relating to developmental policies in much of tropical Australia emanate.

The pastoral properties acquired by the Hooker Corporation possess the advantage of being well spread and they have progressed far beyond the stage of pioneering development, but as yet the Corporation is an unknown and untried quantity in the pastoral field. Under the terms of the deal opportunities seem to exist, however, for the ploughing back of profits on the cattle stations for several years to come. The Corporation's expressed intention to adopt this course and its announcement that this large-scale infusion of capital will be accompanied by similar infusions of enterprise and vision may well augur the opening of a new chapter of north Australian development.

The Corporation's development programme involves the building of fences, the sinking of bores, the introduction of hundreds of bulls to improve the breed, radical changes in transport methods and possibly the construction of abattoirs—involving the expenditure of as much as £A1 million in due course.

If the venture is successful it could well serve as a lead for the planned and large-scale infusion of capital in the far north from other quarters which have hitherto regarded it as a risky field for investment.

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THE BUILD OF WEST ANTARCTICA

Everybody knows that during IGY manpower, logistic support and scientific equipment were deployed in the Antarctic as never before, and everybody assumes that as a result of all this effort our knowledge of Antarctica has been substantially and significantly increased. This assumption need not necessarily have been correct, since much of the scientific effort was concerned with the investigation of geophysical phenomena which are simply better observed in high latitudes, or for which data from high southern latitudes were required to fill out a world picture, rather than with investigations of the Antarctic continent itself. It now appears, however, that a series of "oversnow traverses" by three United States teams of scientists operating in Sno-cats has resulted in new information so striking and so abundant that we may fairly say that a new phase in our understanding of the Antarctic continent—the third, in fact—has opened. The first phase began with Cook's circumnavigation of 1772–74. With the later circumnavigations of von Bellingshausen (1819–21) and John Biscoe (1830–32), and the location of the more northerly Antarctic islands (South Shetlands, South Orkneys and Balleny Islands) by sealing captains and others, both the reality of the southern continent and its restriction to high

southern latitudes were established. Further, the voyages of James Weddell to reach latitude 74° 15′ S in February 1823, and of James Clark Ross to reach latitude 78° 4′ S in February 1841, revealed the two great marine indentations of the continental outline that bear the names of these two able navigators. No fundamental increases in knowledge accrued for over fifty years until the great expeditions of the beginning of the present century revealed that the interior of the continent is occupied by an immense ice plateau in which the South Pole is situated some 10,000 feet above sea-level—an essentially new geographical concept. These expeditions also revealed something of the geological contrasts between the mountains of West Antarctica, that Henri Arctowski had felicitously called the Antarctandes from their resemblances to the Andes of Patagonia, and those bordering the Ross Sea that Edgeworth David had shown to be of horst structure. Later observations have tended to strengthen the surmise that plateau structures may be typical of the vast area (three million square miles) covered by the almost unbroken ice plateau of East Antarctica, while geosynclinal structures may characterize West Antarctica, the smaller portion of the continent (1¼ million square miles) lying toward the Pacific beyond the Ross and Weddell indentations. As early as 1930 Griffith Taylor suggested the possibility of a structural depression uniting these two indentations and separating the East and West portions of Antarctica. In the last twenty-five years this picture has been much clarified in detail and the names of many new coastal features and interior mountains have been added to the map. The extent of this clarification should not be underestimated and is well shown by comparison of the map of Antarctica at the scale 1/6,000,000 published by the American Geographical Society in 1956 with any pre-war map or chart of the continent. Nevertheless, the fundamental questions implied in Griffith Taylor's speculations—How thick is the ice underlying the interior plateau? Is the Antarctic "continent" a unitary or a composite land mass?—remained unanswered.

The beginnings of an answer were suggested by the results of a seismic traverse by the joint Norwegian-British-Swedish Expedition of 1949–52 in Dronning Maud Land which penetrated some 400 miles from Maudheim up on to the interior plateau at 2700 metres. This showed that, here at least, very considerable relief of the rock floor is buried beneath the ice carapace. (G. de Q. Robin, *Norwegian-British-Swedish Antarctic Expedition, 1949–52, Scientific Results, Vol. V. Glaciology III.* Oslo: Norsk Polarinstitutt, 1958.) The Commonwealth Trans-Antarctic Expedition of 1957–58 showed that the same is true on a larger scale along the meridians 30° W and 150° E. Indeed, between South Ice (latitude 81° 40′ S) and the South Pole the rock floor was shown to descend some hundreds of metres below sea-level in two places (P and Q on Fig. 2) separated by mountains rising 1800 metres above sea-level. (H. Lister and G. Pratt, "Geophysical investigations of the Commonwealth Trans-Antarctic Expedition", *Geogr. Journal*, vol. cxxv, 1959, pp. 343–56, Fig. 4.)

The new results achieved by the Americans, however, are on an altogether more ample scale and have led to drastic revision of our picture of Antarctica. They are derived from a series of traverses radiating from and linking the three United States IGY bases at Little America on the Ross Ice Shelf,

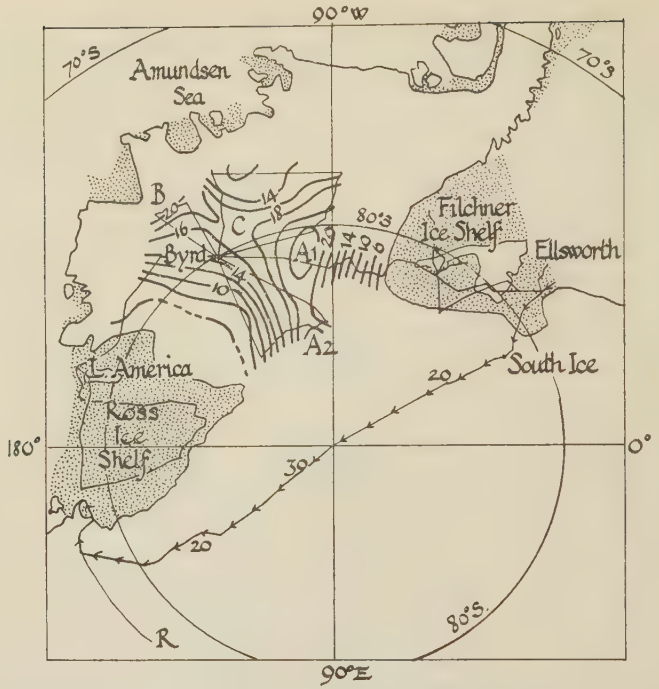

Fig. 1.—Altitude of the ice surface in West Antarctica. Altitudes in hundreds of metres: contour interval 200 m. Lines joining named stations are traverse lines. Route of T.A.E. ornamented by arrow heads. Areas of close stipple: ice shelves. For explanation of letters A1, A2, B, C and R, see text.

Ellsworth on the Filchner Ice Shelf, and Byrd in the interior of West Antarctica at 80° S 120° W. The position of the bases and the traverse lines are indicated on Fig. 1, which is based on information in the account given in the issue of *Science*, the organ of the American Association for the Advancement of Science, that appeared on 15th January of this year. (C. R. Bentley, A. P. Crary, N. A. Ostenso, E. C. Thiel, "Structure of West Antarctica", *Science*, vol. 131, no. 3394, 1960, pp. 131–36, Figs. 1–4.) Fig. 1 also shows the new, revised outline of the Filchner Ice Shelf, reaching much further inland than was supposed before IGY and broken by a large island, together with contours of the ice surface at 200-metre intervals. The route of the Commonwealth Trans-Antarctic Expedition is also included and some indication of ice surface altitudes along it. It will be seen that along this traverse, believed to typify much of the plateau of East Antarctica, altitudes exceed 2000 metres almost throughout and attain 3000 metres around 88° S 144° E. In contrast, altitudes greater than 2000 metres in West Antarctica are found only in restricted areas (A^1 and A^2) on or near the hundredth meridian and south of the eightieth parallel, and again towards the coast near 77° S and 125° W (B). Connecting these culminating areas, which are of course areas of glacial outflow, is a saddle (C) receiving ice from both A and B, with outflow westwards towards the Ross Ice Shelf and northwards towards the Amundsen Sea. Descent of the ice surface from A, toward the Filchner Ice Shelf is relatively steep—though it

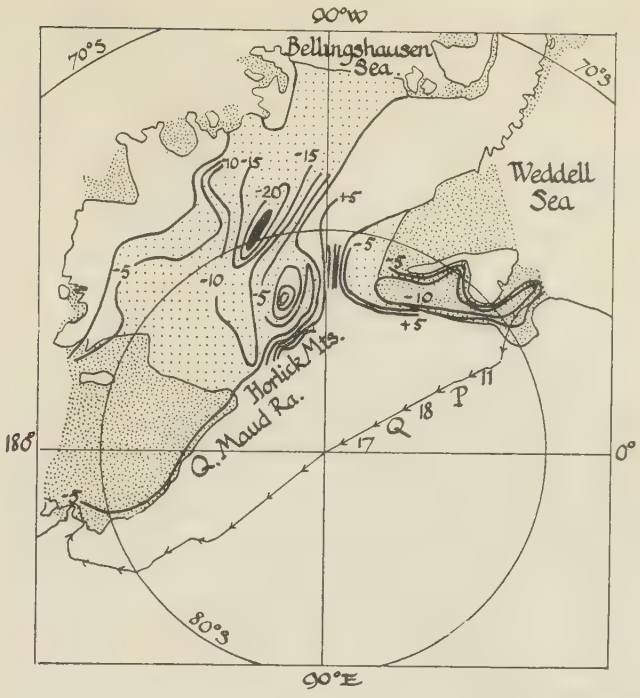

Fig. 2.—Altitude of the rock base of the West Antarctic Ice cap. Altitudes in hundreds of metres: contour interval 500 m. Areas of close stipple: ice shelves; areas of open stipple: rock base below sea-level; area shaded black: rock base below −2500 m. For explanation of letters P and Q, see text.

should be realized that "steep" here refers to an overall gradient of 1/165 or 32 feet per mile, which would not incommode an express train.

More interesting even than the ice surface contours are those drawn as the result of seismic and gravity observations showing the form of the rock surface below the ice (Fig. 2). It appears that along most of the American traverses rock floor has been found to be well below sea-level, and, indeed, at such depths that it must have been below sea-level even before the ice cap accumulated and caused isostatic depression of the continent. To the east of Byrd Station a deep trench was crossed by four traverse lines: its deepest part is more than 2500 metres below sea-level today, and since the contour for −1500 metres opens widely to the northeast it is thought that this great depression continues below sea-level in this direction to the Bellingshausen Sea. Westward the area in which rock floor is more than 500 metres below sea-level certainly continues below Marie Byrd Land to the Ross Ice Shelf. There is thus reason to believe that the coastal highlands from King Edward VII Land to the Walgreen Coast at 95° W are separated from the possible continuations of the Antarctandes in the interior by a major depression, large enough and deep enough to contain below sea-level all the mountain area of both Norway and Sweden. The deepest parts of this depression appear to lie beneath the saddle of the ice surface (C of Fig. 1). This implies that the ice caps of West Antarctica originated in two separate areas—the coastal highlands and the interior

mountains—and by extension filled the strait between till in the central parts the ice became 4000 metres (2½ miles) thick. Moreover, the available geological evidence supplemented by the evidence from measurements of magnetism and seismic velocities in rock suggests that the depression separates areas of contrasted geological make-up—volcanic rocks predominating in the coastal highlands and sedimentaries in the interior ranges. If the latter do indeed represent continuations of the Antarctandes the question arises as to their relations to the Antarctic Horst of the Queen Maud and Horlick Ranges, and of any possible low-level connection between the Weddell and Ross depressions. The new observations indicate that rock is below sea-level for some distance inland from the interior margin of the Filchner Ice Shelf, and is found within 150 miles of part of the Ross-Bellingshausen trough. Observations from the critical area around 84° S, 90° W, are awaited from an airborne traverse party that has recently been working there, but it is provisionally concluded that no major connection, such as was envisaged as possible by Griffith Taylor, exists between the Weddell and Ross basins. It is, moreover, noteworthy that though the interior mountains of West Antarctica may articulate with the horst structures of East Antarctica near 84° S and 90° W, almost everywhere else the "west-facing" scarps of the plateau of East Antarctica are margined by deep troughs, which, beneath the Ross and Filchner Ice Shelves, descend 750 to 1000 metres below sea-level.

Finally we turn in anticipation to East Antarctica itself. We have already noted that two deep depressions of the rock surface reaching below sea-level were crossed by the Commonwealth Trans-Antarctic Expedition between South Ice and the Pole, in contrast to the situation between the Pole and Victoria Land where rock base lay between 1000 and 2000 metres above sea-level and was covered by about 1000 metres of ice. At a meeting of the British Glaciological Society in Birmingham on 26th February, Dr. Crary gave some indication of results recently achieved on a traverse westwards from the Ross Ice Shelf across the Antarctic Horst in latitude 78° S as far as longitude 132° E (R in Fig. 2). These reveal that in the Australian Antarctic Territory and Terre Adélie the rock base is again extensively below sea-level. The stage is obviously set for further revelations, and the extension of these brilliant achievements by American scientists, and the publication of the scientific results of Russian operations in Australian territory will be eagerly awaited.

University of Birmingham DAVID L. LINTON

The Geographical Association

PRESIDENT 1961

Council has elected as President for 1961 Mr. Geoffrey Hutchings, the first "field geography" specialist to hold this office. Mr. Hutchings is well known to many members not only through his contributions to the literature of our subject but also as one of our senior members who has held various offices in the Field Studies Council, and especially as the former warden of Juniper Hall Field Centre. He is now Senior Tutor in Geography for the Field Studies Council.

SPRING CONFERENCE, DURHAM, 1960

At the Spring Conference held at Durham, a large gathering of members had an opportunity in an ideal setting to study this city, its environs and the surrounding area of varied geographical aspect. For the splendid programme of lectures and excursions, which gave us a valuable insight into a region that is all too often by-passed or never reached, we are most grateful to Professor W. B. Fisher and his staff in the now greatly expanded Department of Geography of the Durham Colleges. This acknowledgment must also be extended to the Tees-side Branch and local members for their help in organizing the conference. We greatly appreciated the hospitality afforded by the Durham Colleges of the University of Durham and by Sir James Duff, Pro-Vice-Chancellor of the University of Durham and Mayor of the City of Durham.

REGISTER OF TEACHERS OF GEOGRAPHY

In a recent newsletter to members of this Association, invitation was made to teachers of geography in the United Kingdom and abroad, willing to consider part-time or temporary teaching posts, to submit their names to headquarters office, including details of qualifications, age and experience. The compilation of a register of such names would facilitate the answering of inquiries for teachers of geography which we receive from time to time.

ANNUAL CONFERENCE 1961

The Annual Conference will be held at the London School of Economics from 2nd to 5th January 1961. The programme will be sent to members, without application, in November; it will give full details of lectures, section meetings and business meetings, and of facilities for the accommodation of members at Campbell Hall.

SPRING CONFERENCE 1961

The Spring Conference will be held at Bristol from 4th to 8th April 1961. Programmes and registration forms for this residential meeting will be circulated to members in January 1961.

FOREIGN SCHOOLS IN 1961

An Easter School in Southern Italy will be held in the Easter vacation 1961, under the direction of Mr. A. F. Martin and Dr. J. M. Houston, both of the University of Oxford, with Rome, Naples and Bari as centres for study excursions. Registration for this course is open now and those wishing to attend should apply without delay.

A Summer School in Germany will be held in August 1961 under the direction of Mr. T. H. Elkins and Dr. E. M. Yates, both of University of London King's College. The course will be centred at Kettwig in the Ruhr valley and at Tübingen in Württemberg, for studies respectively of the Ruhr industrial and rural areas and of the Black Forest and Swabian Jura. Registration for this course will be invited towards the end of 1960.

ANNUAL SUBSCRIPTIONS

The renewal date for subscriptions for the period 1st September 1960 to 31st August 1961 is 1st September 1960. The annual subscription for full members is £1 1s. (the

rate is expected to be increased to £2 as from 1st September 1961, subject to confirmation by the next Annual General Meeting). Members who have not already renewed subscriptions are asked to do so as early as possible. The November issue of *Geography* is supplied only on paid-up subscriptions.

Income tax form P358 can be used by members who are entitled to claim relief of tax for subscription payments. Claims must be submitted to local Inland Revenue offices and not through the Association.

GEOGRAPHICAL ASSOCIATION PUBLICATIONS

Attention is drawn to the list of publications on an advertising page in this issue, which includes announcements about recently published new or revised publications which can be ordered from headquarters office. Payment should be sent with orders.

PERIODICALS—NEW NAMES AND NEW FACES

Amongst new geographical periodicals of which teachers would want to know are two from the Commonwealth. *Tydskrif vir Aardrykskunde* (*Journal for Geography*) is published by the Society for the Teaching of Geography in South Africa. This journal, issued in April and September, has articles in both English and Afrikaans. It costs 5s. per part and can be obtained from the Secretary, Society for the Teaching of Geography, c/o Department of Geography, University of Stellenbosch, Stellenbosch, Cape Province, South Africa. Volume 1 no. 1 was issued in September 1957 and there will be 10 parts to a volume.

Pacific Viewpoint, which comes from the Department of Geography, Victoria University of Wellington (P.O. Box 196, Wellington, New Zealand), will specialize in the study of significant problems of the Asian and Pacific areas and will also present a New Zealand and Pacific view on other topics and regions. This journal will appear in March and September; one volume will comprise two numbers, the price being 10s. ($1.50) per part. Members of the Geographical Association in the United Kingdom may borrow inspection copies of both these journals from headquarters library; articles from both will in future be listed under "Recent Geographical Articles".

In an effort to bring to the notice of geographers articles and scattered literature of geomorphological significance in a large number of journals and occasional publications, *Geomorphological Abstracts* has been launched (No. 1 June 1960). This praiseworthy compilation is the work of many contributors, under the editorship of Dr. K. M. Clayton, Department of Geography, London School of Economics, Houghton Street, London W.C.2, from whom the journal may be obtained. It costs 4s. per issue (post paid) and is published in March, June, September and December. The contents list full sources of selected references with abstracts of varying length.

The Norwegian Geographical Society is presenting contributions which are too voluminous to be included in the *Norsk Geografisk Tidsskrift* as monographs in a new series entitled *Ad Novas*. Two earlier monographs published in 1944 are being numbered 1 (Tore Ouren, "The pulp and paper industry in Trøndelag" in Norwegian) and 2 (L. H. Hertzberg, "Extension of the arable area in three districts of east Norway 1918–39" in Norwegian). No. 3 is by J. Gjessing: "The drainage of the deglaciation period, trends and morphogenetic activity in Northern Atnedalen, with comparative studies in Northern Gudbrandsdalen and Northern Østerdalen", with English summary (18kr.). Titles in this series will be listed in "Recent Geographical Articles".

The British Association has changed the style of its journal *The Advancement of Science*, which will in future attempt to reflect progress in the whole field of science. The journal will now be issued six times a year, starting with May 1960, and costs 7s. 6d. per issue. As geographers know, this journal normally contains one or more articles of strict geographical interest, but there are often papers on topics which have relevance to geographical thought and teaching. The new format of *The Advancement of Science* is very attractive and the illustration is good; it would be useful in both the geography and science departments in schools.

Reviews of Books

With very rare exceptions books reviewed in this journal may be borrowed from the library by full members and student library members of the Association in the British Isles.

North England. Regions of the British Isles. A. E. Smailes. 16 × 24·5 cm. xi + 324 pp. Edinburgh: Thomas Nelson Ltd. 1960. 50s.

North England is arranged in three distinct sections, Parts I and II concerned with the physical setting and the human occupation of the area as a whole, Part III with "regional geography". The third part has chapters on each major sub-division of the area and distinguishes between industrial and rural areas.

In his introduction Professor Smailes suggests, somewhat surprisingly, that readers unfamiliar with geological and geomorphological terms may prefer to begin with Chapter IV. There are some terms used later in the book such as "texture of industrial occupance" and "subsidiary knotting points" whose meaning is not immediately apparent, and to omit much of the physical setting in reading would greatly reduce the value of the book.

The early historical geography is very well handled, particularly in relation to physical conditions, but the last chapter of Part II, entitled "Modern Industrial and Urban Development", brings the story only to 1914; 1850–1914 was the period of rapid development in both the Northeast and West Cumberland, but post-1914 changes have been many and varied. True, many of these changes are recorded in the later chapters on distinctive areas, but, being in separate chapters, the differential impact of the changing national economy after 1918 is by no means so clear as are the local variations in the nature, timing and rate of industrial development so well shown for the period ending in 1914. Status as "Special areas" and now as "Development areas" and their relationships to the remainder of Britain have played a part in recent changes in the economic geography of the industrial areas.

The book as a whole contains a great deal of information and gives a compact and ordered analysis. It is well illustrated, particularly with maps of settlement patterns, and the 46 plates, grouped together, alone give a very good visual impression of contrasting conditions within North England. It should become a standard reference on North England. A full bibliography gives references for further reading.

A. A. L. C.

The Major Land Uses of Great Britain. An evaluation of the conflicting records and estimates of land utilization since 1900. R. H. Best. Wye College (University of London), Dept. of Agricultural Economics. Studies in rural land use. Report No. 4. 14 × 21·5 cm. xii + 113 pp. Ashford: Wye College (University of London), nr. Ashford, Kent. 1959. 10s. 6d.

This study is a valuable guide to the statistics concerning the use of the land area of Great Britain. The analysis of changes in land use since 1900, the information on urban expansion, and the reviews of past estimates of land use are all most interesting and provide much information and an objective basis for class instruction. One learns as much about the limitations of past assessments as of their methods and results, whilst the explanations of the difficulties experienced in compiling the many tables of statistics are most closely reasoned, though carefully and clearly.

The narrowing-down of the acreage of land inadequately classified or unaccounted for in past surveys and returns is shown to be essential if differences are to be reconciled. This search for the lost million acres is urgent if rates of urban growth are to be correctly assessed, for much of the inaccuracy and ambiguity in our present sources of information appears to stem from areas where rural-urban

interaction is most intense. The study illustrates how problems of land-use classification may be solved for these small but critical areas and also considers them in the national perspective.

The book should certainly be used in schools for it provides a directive for local and national land-use studies. B. T. B.

Europe from the Air. Emil Egli and H. R. Müller (ed.). Trans. E. Osers. 23 × 28·5 cm. 223 pp. (incl. 184 plates). London: G. G. Harrap & Co. Ltd. 1959. 63s.

Teachers, especially those who see in the use of selected oblique aerial photographs with the appropriate large-scale maps the logical extension of field work method to regions which cannot be visited, will welcome this volume for its useful source material. Although the physical features of Europe are well covered, it is nevertheless remarkable that two-thirds of these fine clear plates are given to features of human geography. For London these range from a splendid colour photograph looking downstream to one of Wembley Stadium on some "big" day. Eastern Europe, with 5 plates, is sparsely represented in comparison with the west (British Isles 25, France 36). The text is scanty and not of the same high standard as the plates, and there are some identification errors, e.g. Plate 63 labelled Scottish Highlands is in fact the Southern Upland section of the Clyde, and Plate 11, Giant's Causeway, misses the actual causeway formed by marine erosion of columnar basalt by at least 100 yards.

Many teachers nowadays are lucky enough to have good collections of photographs taken during their travels. If this book could be added to the school library, its pictures would be an admirable supplement to such private collections.

R. M. M.

The Atlas of Kenya. 48 × 46 cm. iv pp. + 44 maps + ix pp. gazetteer. Nairobi: The Survey of Kenya. 1959. 50s. + 8s. postage and packing.

The *Atlas of Kenya*, an outstanding example of modern atlas production, is closely modelled on the *Atlas of Tanganyika* which has for long held a special place in the esteem of geographers and other students of that territory. The first edition of this new atlas appears most opportunely when Kenya's affairs are being discussed perhaps more widely than ever before. From its decorative title-page to its useful gazetteer, the atlas is beautifully designed and printed. The maps are bound on the loose-leaf principle, so that additional sheets can be readily incorporated.

The format is sufficiently large to enable the whole country to be presented on one page at a scale of 1/3 million (1 inch = 47·35 miles) with adequate legends and generous margins. Twenty-five maps, on a standard base printed in either grey or brown, present the main distributional features that concern geographers, together with various matters of special interest to the administration. The colours chosen for overprinting are generally very attractive and the type faces used are clear and legible. A series of provincial maps at a scale of 1/1 million (with Nairobi Extra-Provincial District and Environs at a scale of 1/250,000) includes communications, settlement, rivers, etc., with relief shown by contours and layer-tinting: the layer-tinting is confined to the province itself, thereby emphasizing its shape and extent, but of necessity breaking the continuity of many relief features across provincial boundaries.

There are twenty town maps—Nairobi at a scale of 1/25,000, Mombasa at 1/20,000, and the others at 1/50,000—and some historical maps, excellently reproduced on buff paper, ranging from Gastaldi's map of 1564 to Erhardt and Rebmann's map of 1856.

For the next edition thought might be given to the possibility of a less complicated and more meaningful map of agriculture and for a clearer, less crowded map—or

series of maps—of communications. It is unfortunate that the most detailed official map of population has to have a unit dot with a value as high as 5000, and it would be a helpful commentary on the emergence of a multi-racial society in Kenya if there could be maps or diagrams to illustrate the structure of population, particularly its racial composition.

While the atlas is too costly and specialized for most school libraries, it should be consulted by all students of Kenya's geography. The Survey of Kenya is to be most warmly congratulated and thanked for so excellent a production.

A. G. H.; R. W. S.

The Agricultural Regions of the United States. Ladd Haystead and Gilbert C. Fite. 16×23·5 cm. xx + 288 pp. Norman: University of Oklahoma Press. 1955. 42s.

This book can be enthusiastically recommended as a guide to teachers and students of the geography of the United States. Whilst the approach is possibly not strictly geographical, the environmental differences of the various regions are not neglected; indeed, much attention is paid to the consequences of the nature of the types of country with which farmers must deal. The treatment is, in fact, from the farmer's point of view; the reader is quickly made aware of the essential character of agricultural enterprise in the United States, and in many respects this book gives a clearer picture of what goes on, and the background in all its aspects, than do certain more rigorous treatments of the subject.

A. MacP.

Biogeography and Ecology in Australia. Monographiae Biologicae. vol. VIII. A. Keast, R. L. Crocker & C. S. Christian (editors). 16×25 cm. 640 pp. The Hague: Dr. W. Junk. 1959. 65 Dutch guilders.

Written by scientists attached to the Commonwealth Scientific and Industrial Research Organization, the leading museums and Universities of Australia, this book commands serious study by geographers. It tells the story of the numerous surveys carried out as part of a national programme aimed at understanding the environment of the diverse regions of Australia, their opportunity for development and the problems likely to be encountered. These surveys, undertaken by teams of specialists in several fields—climatology, geology, soil science, botany, hydrology, agronomy, etc.—working together, form the basis for planned development. Their importance to Australian development may be gauged from the fact that while the CSIRO has spent nearly £A30 million over the years on research, the agriculture of the continent benefits already at the rate of over £A100 million per annum.

An outstanding feature of the book is its dynamic concept of the elements of the Australian environment. Thus in the chapter on the vegetation of Western Australia the present distributions are explained not merely in relation to present climate, soil, etc., but also in the light of landscape evolution and past geological and climatic change. Apparent anomalies are thereby resolved. The chapter is followed by one concerned specifically with past climatic fluctuation and by another examining the distribution and radiation of the Eucalyptus and Acacia genera, i.e. those most characteristic of the Australian vegetation today. Soils are similarly considered as living organisms subject to continuous change. Since the Pleistocene period man has played an important role modifying or transforming the Australian scene and the chapter on the Australian environment is appropriately followed by one on the ecology of primitive aboriginal man and another on human ecology, the latter by Griffith Taylor, who reiterates the philosophy of moderate environmentalism.

Other chapters of direct geographical interest are those devoted to the vegetation of high mountains, ecological research in semi-arid Australia, the ecology and prevention of soil erosion, Merino sheep, the rabbit, and the eco-complex in its

importance for agricultural assessment, but for those whose interest ranges wider there are fascinating contributions on the marsupial fauna, the ecology and biogeography of Australian grasshoppers and locusts, the distribution and ecology of Australian termites, and the biological control of prickly pear.

The book is illustrated by carefully chosen maps and plates and each chapter carries a valuable bibliography. M. M. C.

The Face of the Earth. G. H. Dury. 11 × 18 cm. xii + 223 pp. Harmondsworth: Penguin Books. 1959. 5s.

This welcome addition to a well-known series of paper-backs is long overdue. The popularity of geomorphology extends beyond the walls of school and college but standard texts are expensive and existing paper-backs on geology rarely cater for readers who are interested primarily in "the history of scenery". This is the book for them. It may also be read with profit by sixth-form pupils and first-year students. It is a semi-popular, well-illustrated (80 plates and 102 text-figures) and refreshingly up-to-date account of the processes and results of normal, glacial, periglacial, arid and marine erosion, of the results of earth-movements and vulcanicity and of the important scenic effects of the Pleistocene Ice Age. The incorporation of results of recent work on the evolution of landscapes and drainage-patterns in Britain makes it particularly useful. So does the inclusion of much new material relating to the behaviour of rivers and the characteristics of their profiles and channels. As the author tells us, controversial topics have not been excluded and the critical reader will no doubt question some of the interpretations. But if this stimulating outline of landscape evolution encourages geomorphologists to take a fresh look at some of their long-held beliefs it will have served a useful purpose. There is little doubt but that it will, as its author hopes, encourage other readers to look at scenery with new eyes. R. S. W.

Land-forms and Life. Short studies on topographical maps. (Revised by Dr. Margaret O. Walter and reset.) C. C. Carter. 12·5 × 19 cm. xx + 296 pp. London: Chatto & Windus. 1959. 12s. 6d.

From its first appearance in 1931 this book has been deservedly popular as a pioneer stimulus to the study of maps in school. It is now thoroughly revised.

The general arrangement is left in its original form, but almost the whole of it has been rewritten up to advanced level requirements, although a few sections do remain in their simpler form and can serve as introductions to foreign maps for the middle school, e.g. Vesuvius, and the Dalmatian Coast.

Recent developments in the explanation of landforms has meant revision of many of the physical sections, but less change is to be found in the human portions. The most drastic changes are the entire exclusion of the chapter on settlement in north Wiltshire and the curtailment of the physical chapter on the Marlborough Downs, both victims of the changes in the map-sheet boundaries. For some older teachers these latter changes may not have enhanced its value as a text-book, but for the younger of us the great service has been rendered of bringing up to date a valuable guide as to what might form a suitable nucleus of a map collection, and, in its many cross-references, as to how they can be incorporated as extensions of regional work in both middle and upper school. R. W. C.

International map of the world on the millionth scale. Report for 1958. United Nations: Dept. of Economic and Social Affairs. 21·75 × 28 cm. 103 pp. New York: United Nations; London: H.M.S.O. 1959. 7s.

The smallest scale map which can reasonably be said to be based directly on survey, as distinct from second-hand compilation; yet the largest on which there is any hope of covering the whole world; the 1:1M Map of the World is particularly

important and interesting. Its specifications, if fully carried out, would lead to the production of a map of very high quality and uniform appearance. But the publishers responsible for the less well-surveyed countries cannot hope to meet these specifications in full for many years to come and rather than delay indefinitely many of them have produced incomplete sheets, ranging from black-and-white outlines carrying only a small amount of information to provisional editions of a standard almost indistinguishable from that prescribed. This United Nations report for 1958, which contains an index map and list of published sheets, does not distinguish between full and incomplete sheets, except to the extent of indicating those which are in monochrome, or which have no layer colouring. It does point out that many of the sheets published by the Geographical Section of the General Staff of Great Britain and by the United States Army Map Service are not available to the public. Included among these are most of the sheets covering Asiatic Russia, central Asia and parts of the Middle East. When it is remembered that some of the remainder are out of print and others difficult to obtain, even through a good map agent, it is obvious that this report must be used with care. Another important point, which emerges from the report of the discussions on revision of the specifications, is the recommendation that the Lambert Conformal Conic projection should in future be used instead of the Modified Polyconic to facilitate production in conjunction with that of the ICAO World Aeronautical Chart at the same scale. A. M. F.

BOOKS AND PUBLICATIONS RECEIVED

Structural Geology. L. U. de Sitter. viii+552 pp. London: McGraw-Hill. 1956. 67s. 6d. Includes extensive list of references.

An Introduction to the Study of Map Projections. J. A. Steers. xxviii+330 pp. London: University of London Press. 1959. 25s. This, the twelfth edition, has some pages of notes added on two unusual graticules used in Part I of the new *Times Atlas*, and on projections used in the U.S.S.R.

Cloud Study. A Pictorial Guide. F. H. Ludlam and R. S. Scorer. 80 pp. London: John Murray. 1957. 12s. 6d. Well illustrated with photographs.

Insect Migration. New Naturalist series no. 36. C. B. Williams. London: Collins. 1958. 30s.

A Guide to Freshwater Invertebrate Animals. T. T. Macan. x+118 pp. London: Longmans. 1959. 11s. 6d.

Publications of the Commonwealth Economic Committee.
Reviews of production, trade, consumption and prices relating to Dairy Produce (1959), Meat (1959), Fruit (1959), Vegetable Oils and Oilseeds (1959), Grain Crops (1959) and Industrial Fibres (1960). London: H.M.S.O. 7s. 6d. each for the first two; 10s. each for the remainder.

A Review of Commonwealth Raw Materials, 37th Report. Vol. I, 1958, 15s.; Vol. II, 1960, £1 15s. London: H.M.S.O. Vol. I reviews generally the situation in Commonwealth countries for a wide range of mineral and organic raw materials and the main sources of energy. Vol. II is primarily a series of separate studies of the raw materials position in individual Commonwealth countries, and illustrates the expansion of raw materials productive capacity in the Commonwealth.

Commonwealth Trade 1950–57. London: H.M.S.O. 1959. 3s. 6d. *Commonwealth Trade* 1958–59. London: H.M.S.O. 1960. 4s.

Fertilisers in the Commonwealth 1950–58. London: H.M.S.O. 1960. 4s.

Annual Report 1958–59 gives information about the regular publications of the C.E.C. London: H.M.S.O. 1959. 1s.

Tropical Products Quarterly. Vol. I, No. 1. March 1960. This new bulletin is intended to cover a number of commodities of interest to Commonwealth countries—cocoa, coffee, spices and vegetable oils and oilseeds. Trends in production, trade and prices in Commonwealth countries are set against a world background. Annual subscription: £1 post free. London: H.M.S.O. or Intelligence Branch of Commonwealth Economic Committee, 2 Queen Anne's Gate Buildings, London S.W.1.

U.S.A. Yearbooks of Agriculture. 1957: *Soil.* 784 pp. 1958: *Land.* 604 pp. 1959: *Food.* 736 pp. Washington: U.S.A. Department of Agriculture. $2.25 each, from the Superintendent of Documents, Washington 25, D.C.

World Political Geography. G. E. Pearcy (ed.). xviii + 734 pp. New York: T. Y. Crowell Co. London: Constable and Co. 2nd edition, 1957. 54s.

Proceedings of I.G.U. Regional Conference in Japan 1957. Published by the Organizing Committee of I.G.U. Regional Conference in Japan and the Science Council of Japan. 609 pp. Tokyo. 1959. Lectures and papers submitted at the Conference, between 29th August and 3rd September 1957, occupying 516 pages, cover a very wide range of aspects of the geography of southeast Asia; they are grouped under Physical Geography, Human Geography, Cartography and Symposium on the Geography of Southeast Asia.

Notes on the Teaching of Geography. Book 1. A. J. F. West and J. Rose. 56 pp. Singapore: Donald Moore, Macdonald House, Singapore 9. 1957. No. 6 in Malayan Teachers' Handbooks.

Multilingual Demographic Dictionary. English Section, 78 pages. French Section, 105 pages. New York: United Nations, Department of Economic and Social Affairs. 1958. 3s. 6d. each. Population Studies no. 29, prepared by the Demographic Dictionary Committee of the International Union for the Scientific Study of Population.

Directory of Natural History and other Field Study Societies in Great Britain. Including societies for archaeology, astronomy, meteorology, geology and cognate subjects. A. Lysaght (ed.). 217 pp. London: British Association for the Advancement of Science, 18 Adam Street, Adelphi, London W.C.2. 1959. 21s. 6d. (incl. postage); 25s. 6d. interleaved copies. In addition to a detailed classified directory of societies, there are an index of publications, on which sources of more obscure titles may be traced, and an index of societies according to geographical location.

Bibliographie Géographique Internationale 1956. International Geographical Union and Unesco. Paris: Centre National de la Recherche Scientifique. 1959. £2 5s.

Books on Communism. A Bibliography edited by R. N. Carew Hunt. 333 pp. London: Ampersand Ltd. 1959. 15s. This general bibliography includes sections on general studies of the U.S.S.R. and the Soviet economy.

Royal Commission on Common Land 1955–1958. Cmnd 462. 284 pp. London: H.M.S.O. 1958. 14s. (Appendix II, History of Common Land and Common Rights by W. G. Hoskins. Appendix IV, The Geographical Distribution of Common Land by L. Dudley Stamp.)

Man and the Land. New Naturalist series no. 31. L. Dudley Stamp. 272 pp. London: Collins. 1955. 25s.

Trees, Woods and Man. New Naturalist series no. 32. H. L. Edlin. 272 pp. London: Collins. 1956. 30s.

Water-mills and the Landscape. K. C. Reid. 16 pp. London: Society for the Protection of Ancient Buildings, 55 Great Ormond Street, London W.C.1. (Wind and Water-mill section.) 1959. 3s.

How Britain's Waterways are used. J. Merrett. 148 pp. *How Underground Britain is explored.* S. Styles. 147 pp. London: Routledge and Kegan Paul. 1959. 10s. 6d. each. Written for lower school reading.

Geologists' Association Guides. A series published to commemorate the Centenary of the Association. Titles already in print: 1, Geology of the area around Birmingham, 3s.; 3, Geology around the University Towns: the Oxford District, 2s. 6d.; 7, The area around Manchester, 5s.; 14, Geology of the Southampton area, incl. Barton and Bracklesham, 2s.; 8, The area around Stoke-on-Trent, 2s. 6d.; 15, Geology around the University Towns: the Durham area, 2s. 6d.; 16, Geology around the University Towns: the Cardiff district, 2s.; 22, The Dorset coast from Poole to Chesil Beach, 3s.; 24, Geology of the Central Weald: the Hastings Beds, 3s.; 25, The Isle of Wight, 2s. 6d.; 26, The Peak District, Derbyshire, 3s.; 27, Geology of some classic British areas: geological itineraries for South Shropshire, 3s.; 28, Geology of some classic British areas: Snowdonia, 2s. 6d. Information and copies from Benham and Co. Ltd., Culver Street, Colchester, Essex.

Geographical Articles

Listed from Periodicals received in the Library

CONTINUED FROM VOL XLV, PP. 153 TO 156

Journals listed here may be borrowed from the Library by members of the Association in the British Isles. References are listed according to the classification published in the *Annals of the Association of American Geographers*, vol. xxvii, June, 1937. Authors' reprints presented to the Library are included in the list of articles.

For abbreviations of titles of periodicals see *Geography*, vol. xlv, Jan.–April, 1960, p. 153. Abbreviations not included there are: IGU—International Geographical Union Newsletter. JTG—Journal of Tropical Geography. MW—Mitteilungen der Geographischen Gesellschaft Wien. PMAS—Papers of the Michigan Academy of Science. SAJ—South African Geographical Journal. SG—Soviet Geography. UC—University of California Publications in Geography.

(E)—English summary. (G)—German summary. *—Maps.

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Some Aspects of Desert Geomorphology

R. F. PEEL

SOME SIXTY YEARS AGO W. M. Davis laid the foundations for systematic studies of the relations between climate and landscape by proposing three basic types of landscape cycle proper to humid, frigid and arid conditions respectively. In more recent years Davis's primary distinctions have been elaborated, on the one hand by the study of morpho-climatic regions, on the other by proposals for distinctive cycles appropriate to intermediate types of climate such as savanna, sub-arid, and periglacial; but if we review in broad terms the progress made in this field since Davis wrote his basic papers one thing stands out, and that is the relatively small amount of study that has been devoted to the arid lands in comparison with the other major divisions. Davis himself has been held in part responsible for this, in that by electing to call humid conditions "normal", and styling extremes of cold and aridity "climatic accidents", he created an unbalanced and misleading picture. But although his choice of terms may have been unfortunate, to blame him for the comparative neglect of dry-land studies is surely unwarranted. His attitude has at least had no such effect on his other "abnormal", the lands of ice and snow; indeed nothing so sharply underlines the neglect of the arid deserts as a comparison of the volume of study devoted to them with that devoted to the glacial regions. In the latter field we have by now almost a subject in itself, nourishing a vast literature of thousands of articles, several specialized journals, and shelves of weighty texts and major monographs. But the geomorphologist interested in deserts will find no single journal devoted exclusively to his interests, an article literature to be numbered only in hundreds, and no comprehensive textbook more recent than Johannes Walther's *Das Gesetz der Wüstenbildung* first published in 1900. And yet, as L. C. King and others have repeatedly stressed, by any definition the dry lands occupy a good third of the earth's surface, whereas glaciation, although expanded to cover about the same fraction during the Pleistocene maximum, today affects no more than about ten per cent.

It would be interesting, but would take us too far afield, to review the reasons for the comparative neglect of the earth's deserts. More pertinent to the present paper are the facts and their results. Until a

➤ Professor Peel, head of the Department of Geography of the University of Bristol, read a paper on which this article is based at the Annual Conference of the Association in London on 31st December 1959.

decade or two ago the majority of the earth's great deserts, although civilization grew up around their edges, had remained astonishingly unknown in any exact and scientific sense. The interior of the Libyan Desert, for example, an area of size comparable to peninsular India, was effectively penetrated for the first time as recently as the late 1920's, and substantial tracts of it, as of the rest of the Sahara, still remain very little known. Things have indeed been changing fast in the years since the last war, particularly with the scientific surveys of arid Australia conducted by C.S.I.R.O., UNESCO's Arid Zone Research Programme, and the vast amount of prospecting and geological work carried out in the Sahara in consequence of important oil and other mineral discoveries—to say nothing of the employment of desert tracts for nuclear experimentation. But little of the new information that has resulted has yet found its way into our textbooks, and geomorphology has entered into the investigations only in minor degree. It remains true even today that for a large fraction of the earth's desert lands we have no detailed and reliable topographic maps, no continuous geological surveys, and only the most generalized data on physiographically important aspects of climate and hydrology. Specific geomorphological studies, although increasing, are still few and far between in comparison with the areas involved, and a large proportion remain of a reconnaissance character. Relatively few studies based on reliable measurement, whether of forms, conditions or processes, are as yet available.

The results of this situation are familiar enough. In the majority of our textbooks the accounts of arid-land geomorphology remain brief, somewhat standardized, and markedly unbalanced; inevitably so, since they rely on limited material of varying age and reliability and on studies and opinions far from evenly distributed or fully representative. And in this last context it must be noted that in sharp contrast to most of the arid zone one corner of it has been remarkably well studied, and from it has poured out a copious stream of excellent descriptive work and interpretative theory. This area is the "Arid Southwest" of the United States, classic ground for the field geologist; but although the American material is of the greatest value, it must be kept in correct perspective. In various ways the "Arid Southwest" is not very typical of the earth's great deserts, being much more diversified and in large part only sub-arid; while in its totality it comprises only a small sample of the whole. When we recall that the whole of the United States could be comfortably placed inside the Sahara alone, with enough space left over for several European states, it will be apparent that we should be chary of basing world judgements too freely on what may well be true of California and Arizona. This point must clearly be borne in mind in reading many textbooks which, in the absence of other information, necessarily tend to rely largely upon the American material.

The purpose of the present paper is to draw attention to this general situation in dry-land geomorphology, and within that picture to illustrate some of the uncertainties that beset us by discussion of a few selected topics and features. These have been selected rather arbitrarily, and limitations of space preclude any full discussion even of the few themes touched on.

GENERAL CONSIDERATIONS

Since they owe their existence entirely to meteorological causes, the earth's present deserts include within their confines regions with all kinds of geological history, structure and tectonics; but although they include large tracts of mountains of various types it so happens that the greater part of the present deserts lie upon ancient land-surfaces of marked stability. Plains therefore, of varying character, altitude and origin, bulk large in their morphological make-up. In physiographic conditions the outstanding features are well known: a marked infrequency and irregularity of rainfall, both in time and place; typically dry air; strong daily insolation and nocturnal radiation; and a marked sparsity, amounting over great tracts to a total absence, of vegetational cover. With the latter goes a general absence of true soils, the superficial deposits remaining for the most part purely mineral and incoherent unless chemically cemented. These conditions are of course present in very variable degree, for just as no sharp boundary can be placed around the arid zones so they exhibit a wide internal range in degree of aridity. But in some measure the features mentioned are definitive.

In attempting to interpret the landscapes of desert tracts, however, a fundamental problem is how long conditions have been as we now see them; a problem which raises the question of how much of the present scenery is truly the product of current conditions and processes, and how much residual (though no doubt in some degree modified) from past periods of possibly quite different conditions. Elucidation of the climatic history is thus a matter of quite basic importance if we are to form any true appreciation of the scenery in arid tracts and to this we must add an understanding of past geological history, for this also varies greatly within the desert zones. More recent studies have indeed made it appear very doubtful if any attempt at formulation of broad landscape theories for the arid environment can be safely undertaken until we know a lot more about the past geological and climatic histories of the areas from which we must draw our evidence, but these matters will be touched on again later in this paper. For the moment it is convenient to confine discussion to present conditions, and to the evolution of theories widely held.

The earlier scientific explorers of our deserts, seeing no surface water, experiencing no rain, and finding the scenery that met their eyes both unfamiliar and astonishing, concluded in some cases that they were

traversing the unmodified floors of former seas, in others that the bizarre landscapes they encountered must have been carved out entirely by the actions of solar heat and wind. Closer studies however led to different conclusions, and for some time past most geomorphologists have been united in the opinion that apart from its patent importance as an agency of dust-removal and dune-building the part played by wind in creating the desert landscape is probably nothing like so great as pioneers like C. R. Keyes supposed,[1] and that improbable as it might appear the dominant agency of land-sculpture throughout the desert lands remains flowing water. There is indeed much evidence to support this view, both in the field and in theory. Great tracts of our present deserts are dominated by features which can only be reasonably explained on a water erosion hypothesis, while it seems probable (if not entirely certain) that there is no spot within them on which rain *never* falls. The significant physiographic difference between the desert and the humid land can indeed in this particular be correctly stated as one of degree rather than kind, consisting essentially in comparative frequency of rainfalls; the average interval between being perhaps a week in the one, as against a year, five years or even ten or twenty in the other. Once rain has fallen in sufficient quantity to initiate runoff, the latter will patently be governed by the same physical laws in both regions (although the contrast in governing conditions may make it take different forms and produce somewhat different effects); and provided that no other active processes are working during the long drought spells in ways which obliterate and counter the occasional water erosion, the effects of the latter, although only occurring for short periods at lengthy intervals, may well be accumulative. Arguing in this way, and making due allowance for the lack of large-scale co-ordinated drainage systems and a single riverine base-level, one can reasonably arrive at a conclusion similar to that of Davis that although the process may be disconnected, intermittent, and thus greatly slowed down, water erosion can continue to dominate the desert landscape cycle at least until it reaches a very advanced stage. But this assumes, of course, that no other processes acting more continuously, and perhaps in other directions, arrest or counter the progressive and cumulative effects of the occasional water action; and whether this is true or not is patently a key question in desert geomorphology.

Of such possible processes two are obvious; the one being wind erosion and transport, the other general weathering. It is not intended here to discuss the proved and possible contributions of wind action to desert landscape in any detail, although from every point of view we know all too little about them. Indeed, despite the major advances made by R. A. Bagnold and others in elucidating the mechanics of sand-movement and dune-construction, and the painstaking studies of soil-blowing by wind conducted in America and elsewhere, it is still perhaps true to say, as did Eliot Blackwelder, that the relative importance

of wind "is one of the most important unsettled problems of desert geomorphology".[2] But in general terms it would seem possible to summarize current opinion in the following way. Acting unaided on strong coherent bedrock wind has negligible erosive effect, although it may in some measure assist weathering by bringing in water vapour on the one hand or by evaporating water from the rock on the other; but when the surface formations are soft and friable, or when strong rocks have been weathered to a sufficient state of fineness and incoherency, wind has considerable powers of erosion by removal. J. A. Udden emphasized the tremendous theoretical capacity of wind in this respect long ago,[3] and we have now a good deal of observational data from studies of soil-blowing in the American "Dust Bowl" and elsewhere to reinforce both theoretical calculations and the tacit evidence of vast quantities of exported dust redeposited as loess around the peripheries of many desert areas. This action, termed deflation, is almost certainly the most important erosive action of wind, far transcending the abrasive erosion effected by the coarser particles of sand-grade during their transport. The latter, the familiar "sand-blast" action, is clearly responsible for the production of distinctive fretted surfaces, the shaping of pebbles into dreikanter, and other small-scale effects, but no incontrovertible proof seems ever to have been advanced that it can carve out major landforms or contribute in important degree to general denudation. The combined erosive effects of wind thus seem to be controlled primarily by lithological considerations expressing themselves in the rate at which particles small enough for the wind to lift and carry away are released from parent rock, and if we leave aside unconsolidated surface deposits, this would seem to be essentially a function of rates of weathering. Weathering also interrelates intimately with the occasional actions of water in that during the long drought spells great quantities of rock wastes are created which, in their transport, rapidly abstract most of the available energy from the ephemeral streams and sheet-floods. According to many theories also static weathering, assisted by gravity removal of loosened particles, plays a leading role in the slow retreat and shaping of steep slopes. Weathering processes are thus patently of fundamental importance in the slow evolution of desert landscapes, yet our certain knowledge about how they work and combine seems to be still somewhat confused and inadequate. Some discussion of this subject thus seems appropriate.

DESERT WEATHERING

The relative absence of vegetation and soil exposes a large fraction of bedrock to direct atmospheric weathering in many desert locations, and in hilly ground the bare rock is typically littered with rock fragments and residues. From these the wind constantly sifts out the accessible finer particles as they form, carrying much of the dust right out of the desert zone, and concentrating the slower-moving sand in particular

localities. Impressed by the enormous quantities of rock-fragments, often markedly angular, the apparent total absence of water, and the exaggerated temperature differences between day and night (often, for rock surfaces, of the order of 100° F.), earlier observers concluded that the dominant agency at work must be thermal shattering, operating through the cyclic stress differences imposed by repeated volumetric changes. These, it was argued, would tend rapidly to break up and detach the surface layers of bedrock, and would continue to attack loosened boulders and fragments even to the extent of reducing them to granular form by breaking the bonds between crystals or particles of minerals with different coefficients of thermal expansion. David Livingstone, with other early and more recent travellers, reported hearing rocks burst with pistol-shot reports under this action, and scientists like Walther, Ball, Hume and Lucas demonstrated that the stresses and strains involved were quite sufficient to produce the observed results.[4] The same kind of process was invoked to explain the onion-skin exfoliation so commonly to be seen on massive crystalline rocks in the deserts. Serious doubts were first cast on this theory by the observations of D. C. Barton in Egypt and Eliot Blackwelder in America. Barton, studying ancient monuments in Egypt, found that weathering of the stonework was in general more pronounced in the Delta than higher up the Nile valley, and that on any individual monument decay was universally at a maximum on those parts which remained constantly in shadow, and least of all on surfaces directly exposed to the sun and to the maximum heating and cooling. These results he interpreted as implying that in contrast to previous theory insolation and radiation in anhydrous conditions produced no appreciable weathering effects, the main enemy being here, as elsewhere, moisture.[5] Blackwelder's field observations in America, reinforced by a careful study of the Mormon Temple in Salt Lake City, produced a like result, and in a series of papers he urged that the thermal-shattering theory of desert weathering was quite mistaken, and that in deserts, as in the temperate humid lands, chemical weathering involving water was the real destroyer of rocks. This thesis he applied even to massive exfoliation.[6] A further blow to the traditional theory was given by various laboratory experiments, including the often-quoted experiments of D. T. Griggs. In these Griggs exposed a polished face of granite to some 90,000 fifteen-minute cycles of alternate heating and cooling over a temperature range of nearly 200°F. (far greater than anything experienced naturally in the deserts) and found the rock totally undamaged at the end. Repeating the same experiment but using a cold-water spray for the cooling part of the cycle, however, Griggs found that the whole block very quickly disintegrated.[7]

Further studies have been made of these matters in recent years, but the conflicting statements still to be found in textbooks underline the

fact that we have not yet established with any certainty the relative importance of different weathering processes in deserts. The occurrence of pebbles split as though by frost, no less than the angularity of many rock fragments, seems to support the thermal-shattering theory, and Dury has recently cited as evidence for it the spreading abroad and down-slope working of rock fragments.[8] But a large volume of evidence has grown up pointing conclusively to the great importance of chemical processes. It is difficult to conceive how the many tor-like forms, pedestal rocks, rock pinnacles and arches, to say nothing of tafoni and rock cavities, could be formed by any purely mechanical process of weathering; and direct evidence of chemical decay is often to be found in the deep rotting of exposed rock surfaces especially of the plutonic igneous rocks. Pediment surfaces in the Mohave Desert were found by the writer in 1955 to be occasionally rotted to a depth of a foot or more, so that the power-scrapers used to level minor roads cut away that depth of bedrock without difficulty; and when climbing Gebel Kissu, a 5000-foot granite peak in the southern Libyan Desert, the bare granite was found to be so rotted in places that holds crumbled away into sand. Deep cavities etched out on the undersides of granite boulders, the emergence of incipient rounded boulders from bedrock granite, and the rounding of those boulders when detached all point to chemical processes of felspar decomposition, and it seems clear that for the crystalline rocks at least this process is of major importance.

But such chemical decay implies the presence of water, and a second problem thus arises as to where the water comes from. Blackwelder appealed to the occasional rainshowers, holding that although after them the rock surfaces dried quickly, small quantities of water which had penetrated a short distance into the rock would remain and slowly attack the minerals. This is one possibility, and it must be remembered that in the high temperatures experienced quite small quantities of water mixed with air could be very active. But it seems likely that in many deserts precipitation of night dews may make a significant contribution. Relative humidity readings taken by the author in the Libyan Desert in 1938 showed astonishing increases up to 60 or 70 per cent by midnight after day minima of 10 per cent or less, and successful experiments conducted in Palestine with simple dew-traps support the possibility. The common "vermiform markings" to be seen on limestone fragments in lag gravels* (the German *Rillensteine*) have been attributed to solution by dew films; and even if liquid dew were not precipitated it seems likely that pervious rocks desiccated during the

* The term *lag gravels* is widely used in American geological literature to describe the thin superficial coatings of pebbles or small stones which form the surfaces known as *desert pavement* in the New World, *reg* and *serir* in the Sahara. These surface gravel layers are formed by progressive wind removal of all the finer particles from mixed alluvial or other deposits, leaving the larger stones to accumulate on the surface. When the stones touch one another in a continuous carpet the underlying material is completely protected from further wind deflation (hence the term *armoured surfaces*), and the harder stones of old lag gravels are commonly highly polished by sand-blast and may be cut into dreikanter forms.

day will draw in large quantities of water in the vapour form at night, as L. A. Ramdas has shown to occur in desert soils in the Punjab.[9] The apparent total absence of surface water during the daylight hours may thus have misled observers as to the possibilities of water-motivated chemical weathering even in the driest locations.

To these general comments it must be added that other processes may also be at work to varying degree. Many years ago J. T. Jutson stressed the importance as a weathering agency of the surface crystallization of salts drawn out of the rock in solution by evaporating water. For this action to be potent, larger quantities of water would be needed, and Jutson cited the process as being particularly important in eating away the feet of rock pedestals around the edges of the shallow and shifting West Australian lakes.[10] The writer has wondered whether isolated "finger-rocks" noted in shallow desert depressions in southern Libya, and recorded elsewhere by other observers, which frequently exhibit a similar annular cavity near ground-level, may not have derived it in a similar way from former periodic wetting by some long-vanished sheet of water. This touches immediately on the question of former climatic conditions; but the possibility seems worth recording since such rocks are often cited as positive evidence for the efficacy of ground-level etching by sand-blast. Again exfoliation, which is not of course confined to desert areas, has frequently been explained in part at least as due to spontaneous dilatation of rock masses through "unloading" as the originally super-incumbent strata were removed. In many cases this seems the most likely explanation, but various different factors may be involved in different cases.

Before leaving weathering brief mention may be made however of processes commonly observed in desert areas which may not be directly destructive to rocks, and may even be preservative. A wide variety of surface incrustations and mineral skins has been recorded, under the general term "desert varnish", although this should perhaps properly be restricted to a limited group. The true desert varnish presents intriguing problems to the mineralogist and rock chemist in terms of the physics and chemistry of its growth and the origin of the manganese which is so prominent a constituent of it,[11] but it does not seem to have any particular physiographic importance save in cases where it may cover large expanses of rock and help to preserve them from destructive weathering. The much thicker hard blackish "rind" so commonly observed as an outer coating on loose blocks and fragments of sandstone in the Sahara however may have more significance. Often a quarter of an inch or more in thickness, composed largely of oxides of iron and manganese, and flinty hard, this crust when unbroken effectively protects the underlying material from all weathering and erosion, yet when broken it is found to have drawn out in its growth much of the cementing material from the inner rock which is left weak and is

readily scoured away. Fragments, tubes, "cannon-balls", and other queer-shaped stones made of this material are often a major constituent of the lag gravels which cover much of the *reg* plains in the Nubian Sandstone areas of the Sahara, but it does not yet seem to have been established with certainty whether these fragments represent portions of formerly continuous surface rock-coatings, or concretionary structures which grew within beds of sandstone now weathered away. W. H. Hobbs claimed to have seen this crust widely developed over sandstones near Kharga, giving the rock the appearance of basalt,[12] but more recent travellers in this region have not recorded it in this form, and opinion seems to favour an original growth within the parent rock. Studies of deep weathering in the moist tropics record growths astonishingly similar[13] and the question is thus raised as to whether this black crust, though so typical of the desert, really originated in an arid climate at all.

The same kind of problem attends the last phenomenon of this type that can be mentioned; the much thicker superficial formations which have come to be known as "duricrusts". Described thirty years ago by Woolnough in Australia[14] these occur as thick indurated formations, often 20 feet deep, bonded by cements which may be ferric, calcic or silicic and are often extremely hard and resistant. The American caliche is a formation of this type, as are the thick and tough silcretes described by du Toit, King, and Frankel and Kent in South Africa.[15] In Western Australia the formations are more commonly iron-bound, and termed ferricretes. Physiographically these formations, where they occur, may be of considerable importance, for they seem to occur only on ancient erosion surfaces of marked lack of relief, but when the latter are uplifted and dissected the duricrusts form a protective cap-rock and as such contribute significantly to the development of characteristic flat-topped mesas and vertical-lipped escarpments. In themselves, however, these formations offer other interesting problems, for although found widely in deserts it is believed that they too may not be the product of truly arid conditions. Woolnough indeed concluded that the necessary conditions for their growth demanded not only a surface of minimum relief, but a savanna type of climate offering ample seasonal rains separated by long hot dry seasons. The ferricrete variety indeed may well be a kind of fossilized laterite; and the implication is that at the period of its formation Western Australia had a very different type of climate from that which now prevails. Some time ago Sandford recorded somewhat similar fossil laterite in the Libyan Desert[16] again with the suggestion that at some earlier period this part of the Sahara enjoyed a savanna type of climate; and comparable formations have been recorded from the Ahaggar.[17] If these suggestions are correct we may thus have here important evidence bearing on the question of the climatic history of our great deserts.

To complete these scattered comments on aspects of weathering brief mention must be made of the difficult question of relative rates; a matter on which we know all too little. Faced with the profusion of weathered debris the traveller in deserts may initially conclude that weathering must be very rapid; but when one finds lower Palaeolithic artefacts lying sharp and unburied although polished among the surface residues a different picture is presented. We have little concrete evidence on which to base quantitative estimates, but comparatively it would seem that in most desert locations weathering is exceedingly slow; far slower than in comparable locations in the humid lands. This is indicated by the rapidity with which the "Cleopatra's Needles" have weathered since their removal to London and New York in comparison with the trivial damage they had received in 3500 years in their native Egypt, and even more perhaps by the remarkable degree of preservation of prehistoric rock-carvings and paintings on exposed rock-walls at many sites in the Sahara. Such evidence indeed tends to support the view that the drier the climate the less the weathering, irrespective of temperature. Some attempts have been made to estimate weathering rates by study of the growth and decay of desert varnish over roughly dateable prehistoric petroglyphs but with inconclusive results. All that can perhaps safely be said at present is that weathering in deserts seems to proceed very slowly indeed; and the disharmony between this conclusion and the profusion of weathered debris suggests again the possibility of legacies from former conditions of different climate.

LANDSCAPE AND ITS EVOLUTION: MAJOR FEATURES

Although desert landscapes exhibit a wide range or variation it has long been agreed that apart from their lack of co-ordinated drainage systems and thus somewhat chaotic relief the most distinctive feature is the marked angularity of much of the scenery. Mountainous tracts are typically harsh, sharp and jagged. Elsewhere the landscape may be made up of a number of separate almost horizontal levels, more or less dissected, but joined one to another by steep straightish slopes. Or again, vast sensibly flat plains may predominate, sometimes virtually featureless, in other cases dotted with isolated and steep-sided hills which leap up out of the plain "like cliffed islands rising from the sea". The gently flowing curves which in our own countryside normally link hill-top with valley-floor and plain are little in evidence, and may be totally lacking.

Attempts to interpret the evolution of these strange types of scenery began, as earlier noted, with appeal to former sea-floors or to the sculpturing of wind, but in formulating his "Geographical Cycle in an Arid Climate" W. M. Davis visualized the dominant agency as occasional storm-floods aided by persistent weathering; the former dissecting and wearing down the "original mountains" and sweeping

their wastes into the initial deformation basins, the latter assisting in the slow retreat of scarps and the reduction of the residual mountains. Ultimately, in old age, the tectonic basins would have been all filled in, the mountains reduced to tiny residuals or cut away altogether, and broad plains of arid erosion would develop dotted with low-angle rock domes marking the sites of the original mountains.[18] Emerging out of this concept, and extensively discussed both by Davis himself in later papers and by many subsequent writers, came the theory of the initiation and evolution of low-angle erosional surfaces surrounding the dwindling mountains; the features to which W. J. McGee had somewhat earlier applied the term "pediments", and which have given rise to so much controversy ever since.[19]

Since Davis wrote no radically different overall cyclic scheme has been suggested, although opinion has swung over in favour of a more Penckian type of mountain-reduction by slope retreat systematized by L. C. King in his pediplanation theory.[20] Attention on the whole has centred more on specific landscape elements such as the pediment and the forms and features of mountain-face slopes. Before turning to these, however, it is perhaps worth noting that although Davis claimed that his scheme was applicable to any type of initial surface, it was patently geared in substantial measure to the arid landscapes he knew best in the American Southwest. There, in the Basin and Range Province, the high degree of tectonic dislocation permits the scheme to be applied readily and convincingly; but it is not so easy to apply it to some areas in the Old World deserts where aridity may well have overtaken regions of marked stability and already reduced to a plains condition. This matter will be touched on again later.

THE PEDIMENT

So many papers have been written about pediments, and so many varying hypotheses advanced, that it would be impossible to give here any useful account of even the main ideas. Interested readers may be referred to the summary prefacing a recent study of pediments in southeastern Arizona.[21] Despite the extensive literature, however, it seems doubtful if all the problems involved in pediment formation have been fully solved. The true pediment has been defined as a gently shelving mountain-foot slope, faintly concave upwards and steepening towards the mountain, and carved out of bedrock although commonly carrying a thin veneer of detritus in course of transit. Its slope may increase from perhaps half a degree or less at the outer margin, where it usually disappears under an alluvial blanket, to 5 or even 7 degrees at the inner margin. It is often remarkably smooth and undissected; almost straight in transverse profile (parallel to the mountain-foot); and at its inner margin connects, often in a remarkably sharp and clean-cut angular junction, with the rough weathered mountain-face rising behind it at an angle which may exceed 30°. The

general form of the typical pediment makes it appear certain that it has been superficially planed off, if not entirely cut, by flowing water; yet it also appears certain that it can only have grown to its present dimensions by a progressive backward retreat of the original mountain-face which has maintained its contrasting steep angle. The main agency responsible for the mountain-face retreat would appear to be overall weathering, assisted in the removal of its products by direct gravitational sliding and rolling, wind action, and probably above all by rain-wash during storms. From the foot of the mountain-slope further removal of this material is conceived to be mainly the work of flowing water, which in its progression planes off and grades the expanding pediment. But during prolonged and extensive retreat it is not entirely clear how the sharpness of the angular junction between the two surfaces is maintained, and how water-flow having the correct volume, load and flow characteristics can be so suddenly and uniformly supplied at the head of the pediment as to smooth and grade it right back to the foot of the mountain-slope.

Various suggestions have been made to answer these problems, but only one or two can be touched upon here. W. J. McGee, the discoverer of the pediment, suggested that sheet-floods, those distinctive phenomena of the desert, had been the agency responsible for planing off and developing the smooth pediment surfaces,[22] but S. Paige pointed out that for water to adopt the sheet form of runoff demands the prior existence of a smooth gently inclined surface no less than appropriate loading conditions. McGee, he argued, had confused cause and effect.[23] This point is mentioned because several more recent writers on pediments have advanced arguments which seem to verge on the same debatable ground. L. C. King, who has extended the concept of pediments far beyond its original homeland and indeed claimed that features genetically similar can form in the humid European environment, although his broad " pediplanation" theory was first developed and applied to sub-arid lands in Africa, has argued that the dominant agency responsible for both mountain-face (or escarpment) retreat and pediment formation and extension is surface water-flow; the sharp contrast between the two slope forms in inclination and surface character being due to a sudden change in the volume and nature of the runoff.[24] On the mountain-face the runoff is of the "rainwash" type, a network of thin, ever-changing and intertwining threads of water incapable of effective linear erosion, but in aggregate very effective in washing down to the slope foot particles loosened by weathering. With the augmentation in volume downslope, however, at a certain point the character of the runoff changes from what N. M. Fenneman called "unconcentrated wash" into "concentrated wash", with much greater erosive and transportive capacity.[25] This "change-over" line marks the junction between mountain-face and

pediment, and downslope from that line the rock is carved away into a smooth upwardly concave graded slope, whose undissected character results from the heavily loaded condition of the runoff which forces it to act in the manner of a braided stream with constant lateral migrations and planation, or even as a sheet-flood, with dominantly laminar flow. Quoting King: "But, as the angle of slope falls off . . . threadflow soon becomes incapable of removing the volume of precipitation: the threads join up into sheets . . . and a land-form is needed that can dispose of sheet-flow. *This land-form, adapted to, and moulded by, sheet-flow of water is the pediment.* It can dispose of the large volume of water produced by a thunderstorm of intensity 3 or 4 inches per hour more efficiently, more quickly, and with less damage to the landscape than any other topographic form: it is the answer to the thunderstorm and the cloudburst."[26]

King, both from his own observations, and from those of T. J. D. Fair that he quotes,[27] leaves no doubt that the general character of runoff flow *does* alter at the slope-junction; but it could be expected to do so as a result of the sudden change in slope-angle if this had been caused in other ways, and it is not easy to visualize how such a sharp and sudden change-over in nature and result of runoff could develop along such a regular line without some pre-existing break in the topography. J. A. Mabbutt, treating pedimented forms in Little Namaqualand, recognizes this hen-and-egg difficulty, in that he suggests that the smooth pediment surfaces themselves are in part the result, in part the cause, of the sheet-wash type of runoff which crosses them;[28] but the mechanics of development and maintenance of the sharp angular junction of the two slope forms still seems to the writer to present difficulties not wholly explained. If we are to treat the whole profile, mountain-face and pediment together, as a continuous unit dominantly developed by surface water-flow throughout, there is little in current stream-profile theory to suggest an explanation. E. Yatsu has presented interesting evidence of stream-profiles in Japan which display angular breaks (or at least the linkage of two different exponential curves) which he attributes to the dominance of two markedly different grades of load material with a lack of material in the size ranges between them,[29] but it is not easy to see an explanation of the pediment form in these terms. If, on the other hand, we consider that the mountain-face retreats primarily under weathering (as many have held), and that the pediment, apart from its surface smoothing by flowing water, develops essentially by weathering-retreat of the mountain-face slope-foot, equal difficulties arise in explaining how the junction-line remains so even and regular in level, and so sharply cut. Space will not permit development of these themes, but it seems that despite all that has been written about it the pediment landform has not yet been fully and convincingly explained in terms of physiographic processes. Tuan's conclusions about the Arizona pediments which he has recently studied

in detail, although revealing a number of morphologically different types and favouring the kind of evolution originally suggested by A. C. Lawson rather than that championed by D. W. Johnson, do not materially extend our understanding of the mechanics.[30]

But apart from the tantalizing problem of how pediments develop, questions arise as to how essential a feature they are of desert landscape in general, and therefore of whether general landscape evolution theories which incorporate pediment generation are of universal validity. True pediments very similar to the American examples have been recognized and described in various parts of the Old World deserts, but there is much evidence to suggest that in many parts of arid Africa, for instance, they are little in evidence or even totally absent. S. Passarge, writing of the *Inselberglandschaft* of the Kalahari, stressed that the "island-mountains" had no surrounding belt of transitional hills, and no intermediate slope separating their steep flanks from the plains,[31] and in many parts of the Sahara photographs reveal tower-like hills and mountains rising from the surrounding flat plains without the intervention of any recognizable pediment. Features of this type are particularly well developed in the massive older Palaeozoic sandstones from which the dissected Tassili plateaux have been carved, as in the Ajjer region, in Ennedi and around the flanks of Tibesti. Without detailed ground investigation it is difficult to know how much a superficial flattish cover of blown sand may contribute to the "marine stacks" impression of these features, but in the neighbourhood of hills such sand, unless built into recognizable dunes, is likely to be thin; and in the southern Libyan Desert the writer noted substantial inselberg mountains not only lacking any recognizable pediment, but also in some cases being possibly surrounded by a slight annular depression comparable to that surrounding some of the haystack inselbergs of Nigeria.[32] Unfortunately this visual impression could not be checked by measurement on the ground, and the writer is not aware of any detailed studies based on measurement conducted in the regions of extreme aridity in the Sahara or elsewhere which might throw light on this question. Indeed, as was stated at the outset, a recurrent difficulty in trying to assess the validity of existing theories of desert landscape is lack of sufficient reliable field data to allow us to judge how well they fit the existing facts; and the pediment is of course only one of the range of landforms to which this element of uncertainty is attached. Lacking basic surveys we cannot even say with any precision and certainty what *are* the dominant landforms in the Sahara or Arabia; and until adequate measurements of forms, and related geological information, are available on a much wider scale than at present it might well be held waste of time to debate interpretative theories. But whether the flat surfaces around "haystack" inselbergs in the Libyan Desert are truly very low-angle pediments or not, attention might again be drawn to a basic difficulty inherent in many of the general theories relating to the

evolution of arid landscapes. Nowadays almost all ideas incorporate in some measure the notion of lateral retreat of steep slopes "parallel to themselves"; but to allow this to happen the steep slopes must themselves have been created by some other agency as a starting-point. In the Basin and Range Province of the American Southwest such steep initial slopes can be credibly provided on the thesis of multiple block-faulting; but in areas like the Sahara the available geological evidence would seem to rule out this possibility over large areas. Lacking a "starting-point" in the shape of steep slopes created by tectonic dislocation, how can they be provided? L. C. King, in applying his thesis of successive cycles of pediplanation to the whole African continent, suggested a possible answer by postulating a series of continent-wide uplifts. These would cause deep incision of the trunk rivers, whose over-steepened valley-slopes would then slowly retreat laterally across country for hundreds of miles leaving in their wake the familiar level plains.[33] Doubts have been expressed about this idea on quantitative grounds, even supposing the basic mechanism to be correct; but in the Saharan region one might ask in addition where are the major rivers from whose overdeepened valleys the steep slopes could have migrated? It is difficult to envisage any satisfactory scheme in terms of the present geography; but again the question arises, could not the necessary deep stream-valley erosion have been accomplished in some former era of wetter climate, of which most traces have since been obliterated? This possibility directs one's thoughts beyond pediments, residual inselbergs, needle rocks and retreating escarpments to the vast plains which surround them, and some brief discussion of these important features may be attempted.

DESERT PLAINS

In presenting his "Arid Cycle" in 1905 W. M. Davis devoted some space to discussing the possible mechanisms by which extensive plains could be developed under arid conditions. He realized that in this context American evidence was inadequate, and in his discussion relied a good deal on Passarge's descriptions of arid South Africa. While admitting that under conditions of *total* aridity wind would be the only available agency of erosion, and that the later stages of his cycle would probably be much more arid than the initial, Davis found it difficult to imagine wind alone cutting the land surface down towards a smooth and level condition, since he thought that wind would tend to eat out the softer formations and thus create hills and hollows rather than obliterate relief. This tendency, however, he felt might in practice be counteracted by the persistence of occasional local rains and runoff which would wash wastes into any incipient wind-cut hollows and so counter the differential wind erosion. The whole surface, in old age, might thus be slowly worn down to create a true plain of desert erosion which could lie at any altitude in relation to the sea.

Whether any of the great plains which characterize a large fraction of our major deserts have indeed originated in this way remains a problem by no means fully resolved; but for areas where studies have been made in the field opinion in general seems to be against Davis's suggestion. In the Sahara, for instance, some of the large featureless surfaces lie across enormous spreads of alluvial material, from which wind has sifted off the surface "fines" to leave a protective coating of *reg* gravels. Such surfaces are clearly in large measure of constructional origin, whatever the form of the buried rock-surface; and the same is true of the great clay plains common along the southern fringes of the Sahara described by Dresch and others.[34] In other areas level plains have a surface coating of wind-blown sand, which again contributes to their level featureless appearance, but probably only in small measure since away from dune-fields and ergs the sand is likely to be a thin veneer. In others again, however, the bedrock is widely exposed at the surface. On this latter type some examples carry a variable sprinkling of residual haystack hills, but others are totally smooth. One such is the great Selima Sand Sheet on the Egypt–Sudan border, an area of several thousand square miles whose surface is for the most part of a billiard-table smoothness. The whole area, so far as survey data are available, would seem to slope very gently towards the north and east, but at average gradients of only 2 or 3 feet per mile, and although its surface is uniformly covered by a flat sheet of blown sand this, where plumbed, has been recorded as only about a foot thick. Essentially therefore this area would seem to be a vast erosional plain cut across the Nubian Sandstone rocks, of quite extraordinary smoothness, extent and levelness. How are such vast erosional surfaces, which have also been recorded in Arabia and other of the great deserts, to be explained?

Various possibilities are theoretically open; but few writers have favoured the wind as a major agency. As Davis quite rightly observed, where we can identify evidence of true wind erosion on a large scale in the deserts it is in the form of sculptured features—yardangs, flutings and hollows—and there seems no physical reason why wind should erode towards a level surface. Davis's suggestion that occasional water-action would fill in any incipient wind-cut hollows with detritus is moreover scarcely convincing, since no such action would seem to have hampered the excavation of the great wind-excavated hollows described by Berkey and Morris in the Gobi Desert,[35] or the vast Qattara Depression south of Alamein which has also generally been ascribed primarily to wind erosion. Indeed, the occasional inflow of runoff water into such hollows has been claimed as a contributory factor in their excavation, in that it leaves residual moisture in them which assists a more rapid weathering of the bedrock. We know all too little about the long-term and large-scale actions of wind to be certain, but the balance of evidence seems to be against it as a primary agency in

the creation of large-scale desert plains, although it may have contributed in important degree to the removal of material from them.

Of other possible explanations some have looked to marine agencies, either in the sense that the rocks forming these great plains are marine sediments uplifted without sensible distortion or tilt, or, where the rocks are patently bevelled by the surface, that sea-waves during slow subsidence cut the surface to its present perfect planation. Evidence is too scanty to warrant discussion of these possibilities, save the remark that in the interior Sahara neither seems very likely; so we are left with the possibility that the plains were subaerially eroded, but not essentially by the wind. This means that they were water-cut, either by flowing rivers (as peneplains), or by the processes of scarp-recession and pedimentation envisaged by King. The exceedingly low gradients which appear to obtain on some of the surfaces raise questions as to the feasibility of either process, but fuller quantitative data are necessary before this point could fairly be argued. The more obvious difficulty, that both processes would demand considerable surface water-flow, and hence a more humid climate than now obtains, is, however, less real than it seems, for as hinted at several earlier points, considerable evidence is accumulating that most if not all of our great deserts have experienced periods of much wetter climate in the past. To this basically important aspect of the whole subject attention must now be directed.

CLIMATIC CHANGE

It has long been realized that quite apart from questions of any minor changes during historic times, all the great deserts have probably experienced phases of more humid climate in the more remote past. The evidence is of many kinds, but in the Sahara for instance there is the presence of numerous old lake-beds, now totally dry and often with the lacustrine mud deposits largely stripped away again by wind; the old strand-lines denoting former much larger lakes in the major depressions, for instance the Chad basin, that of Bodele, and the basin of the middle Niger; and the multiple ancient water-courses radiating out from the mountains, like the Igharghar and Tafassasset systems from Ahaggar, all today dry and often blocked by invading sand-dunes. Biological evidence includes the presence of "relict faunas" including various tropical fish in the Algerian waterholes, the surviving small crocodiles in the pools of Tibesti and Ennedi, and (until they were exterminated) the elephants and lions of the Atlas. The profuse archaeological evidence, in particular that provided by rock paintings and engravings, demonstrates not only that man was able to live freely over most of the Sahara throughout much of prehistoric time, but that an abundant big game of the tropical savanna type inhabited it, and that in Neolithic times there was sufficient grazing for men to herd cattle in areas now totally sterile. All this points to the occurrence

during Quaternary times of periods of substantially different climate. What is much less certain is how much wetter the climate was, when, and for how long. From various lines of evidence opinion widely favours at least two separate pluvial periods, probably separated by periods of considerable aridity, and it is generally assumed that these, like the East African pluvials, were related to the climatic oscillations which produced glaciation in higher latitudes; but the problems of duration, intensity and correlation are by no means fully solved. In the present context, however, the immediately important question is whether, if we are correct in attributing much of the present landscapes to water action, this action took place predominantly or even entirely in some areas during the Pleistocene pluvials, and is hardly continuing at all under present conditions. To adopt this hypothesis would resolve the difficulties of some who have found it difficult to imagine the present intense aridity of large tracts of the Sahara permitting the kind of processes envisaged by Davis to operate effectively at all; but it would mean also that we are looking today at what is effectively a fossil landscape hardly changing except for very slow weathering, the highly infrequent local flood, and the constant sand-moving actions of the wind. This may well be a substantially correct picture; for W. Meckelein and his companions, in their study of northern Libya in 1954–55, felt justified in dividing that area into coastal steppe, semi-desert and extreme desert zones, and found that whereas there were plentiful signs of water-action (present or past) in the two former, no certain signs of recent water-action at all were found in the third which they concluded was a region in which relief was being *conserved* rather than destroyed or created.[36]

If we apply this hypothesis to the major lineaments of the landscape, a difficulty might appear in the question of whether the Pleistocene pluvials were of sufficient duration to permit water-controlled processes to sculpture the landscape to the degree that we must infer. But are we confined to Pleistocene pluvials? Recent studies in the Ahaggar open up much wider vistas. There French geomorphologists, after an extensive study, conclude that throughout the whole of the Ahaggar there is little or nothing in the scenery, save sand dunes and patination on the rocks and pebbles, which can realistically be ascribed to the processes proper to aridity. Little trace can be found of wind erosion; the massive crystallines, volcanics and sedimentaries alike are carved up into a system of water-formed valleys; the granites, particularly at higher levels, are deeply weathered and rotted by processes which seem to demand much more moisture than is at present available; and some suggestions of frost-action and nivation have been recorded. Even lower down, in the fringing plains, these authors saw a striking likeness between the inselberg-dotted plains and those familiar to us in the savanna lands; and their conclusion is that the whole of this landscape, apart from superficial details, is in essentials relict from

Tertiary and in part from even earlier times, and was carved under conditions of abundant seasonal rainfall of the savanna-land type. Aridity, they claim, has preserved this essentially fossil landscape, as it has preserved the alluvial spreads on the great *reg* plains, spreads which, in their structure, show clearly that they were laid down dominantly under considerably more humid conditions.[37]

These conclusions, although they undermine many of our notions about the "arid landscape cycle", are clearly in line with a number of the points made earlier in this paper, and if similar interpretations have general validity many of the difficulties and apparent contradictions earlier discussed disappear. A great deal more study will obviously have to be done in a variety of areas; but it is becoming more and more evident that we are in no position to build up new theories of landscape evolution under aridity by inference from studies of our present desert landscapes until we have a much more certain and complete picture of their climatic background than has hitherto been available.

SAND AND DUNES

Little has been said about wind-blown sand in the deserts, a major subject in itself; but here at least, it might be thought we have a field in which the phenomena are purely the product of current conditions. This is patently in large measure true; but without attempting to enlarge on the many intriguing problems relating to the building of desert dunes, a subject which R. A. Bagnold's brilliant work has done so much to clarify, certain broad questions remain unanswered which do again bring us in contact with problems of past climate. In the Sahara, although some sand is present in most places, the major dune-systems are concentrated in particular regions: the great ergs and sand-seas. What is the origin of all this sand, and why is it so largely concentrated into particular areas? Bagnold himself has argued that the bulk of the sand comes from the breakdown of arenaceous rocks, and this is probably correct since the Sahara is rich in sandstones, themselves in some cases built in part of consolidated ancient dunes; while the great concentrations have been explained on the theory that the active sand has been released by wind-sifting from vast alluvial accumulations, some of which may underlie the great ergs. Oil-well borings, some of which have been made in erg areas, may tell us more about this. There is then the intriguing pattern of the great belts of longitudinal dunes, which fall into enormous arcuate systems spanning the whole breadth of the Sahara. These must surely be governed by the dominant flow of the air-streams across the desert from north to south, but much more meteorological data will be necessary before wind directions and dune trends can be correlated in detail over the whole region and Bagnold's theories about the building of the great seif systems fully tested.[38] Anomalous trends are known, however, especially along the southern fringes of the Sahara where A. T. Grove

has made an initial study of the relations between the orientations of live dunes, and those of older dead systems. Such studies, when more fully extended and based on more certain knowledge of the relations between wind and dune trends, may well throw important additional evidence on past climatic conditions.[39] Other important problems relating to dunes involve fuller understanding of the factors which determine the variable behaviour of sand in different situations; why it builds dunes here, spreads abroad there, and why the different characteristic shapes of dunes occur where they do. And finally, quantitative problems such as the average rates at which dunes of different types grow, extend and migrate invite a great deal more study. Such problems are not only of great interest in themselves. They have obvious practical implications; and again, as has been suggested many years ago, if we knew more about the rates at which the huge dune systems of the Sahara have grown, they themselves might be able to reveal further clues about the climatic past of the region.

CONCLUSIONS

The topics touched on in this paper have ranged widely, and the writer is well aware that the discussion of them has been incomplete and at times incautious. His purpose will however have been fully served if the paper has drawn attention to the great gaps in our knowledge of the geomorphology of a good third of the earth's lands, and to the dangers inherent in much of the interpretative theory that has been produced about desert landscapes. Almost every new study underlines the importance of giving full recognition to local and regional differences in past geological history, structure and lithology; and as knowledge grows, so it becomes ever clearer that basic importance must be assigned to reconstruction of the past climatic history before we can safely finalize our ideas about the nature and significance of any hypothetical "arid cycle". Much information points to the conclusion that the greater the aridity, the less actually happens apart from the actions of the wind; and it seems increasingly probable that a great deal of the scenery in our great deserts is essentially relict from earlier periods, some possibly of great antiquity, and quite probably of very different climatic conditions. The great problem for the future would seem to be to assess how much of the scenic evolution can truly be ascribed to the present desert phase, and until that is established attempts to produce any definite "cycle" of landscape evolution under aridity by inference from the features in our present deserts would seem both dangerous and premature.

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Land-Use Problems and the Evolution of Industrial Landscapes

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THE STUDY OF THE EVOLUTION OF LANDSCAPES has become increasingly important both to the geographer and to the local historian in recent years. There have been many descriptions of the changing rural and urban scene,[1] but few accounts have considered specifically the evolution of industrial landscapes, particularly those produced by mineral extraction. Mining and quarrying have, in a variety of ways, rapidly altered the face of many industrial districts by creating a man-made landscape to replace the natural physical features, or to modify them beyond recognition; crag-like quarry faces, mountainous colliery spoil tips, extensive subsidence lakes, and the "hill and dale" of opencast ironstone workings all exemplify the changes wrought by mineral working, often in a relatively short space of time. This paper considers briefly some general problems of land use in areas of mineral extraction and their significance in conditioning the evolution of industrial landscapes; it then examines, for purposes of more detailed illustration, the evolution of the modern landscape, the land-use characteristics, and the resultant problems of four small areas which are dominated by mineral working.

The most important aspect of land use in areas which are dependent on mineral working is dereliction and its concomitant problems. Derelict land has been officially defined as:

"Land which has been so damaged by extractive or other industrial processes . . . that in default of special action it is unlikely to be effectively used again within a reasonable time."[2] Land of this kind falls into a wide range of categories which reflect the influence of geology and topography, the chronology of mineral working and the techniques of extraction employed, the size and scale of industrial activity, and the degree to which natural vegetation has been able to re-establish itself. The various problems of reclamation and restoration will also reflect these features, and in addition they will be influenced by economic considerations of land values, of alternative forms of land use, and of sources of capital for the work of reclamation.

There is, therefore, not a single problem of derelict land to which a simple comprehensive solution can be applied, but many complex problems which differ from locality to locality. Thus the difficulties

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of the Black Country[3] are not to be equated with those of the Northamptonshire ironstone field,[4] and they in turn are not comparable with the land-use problems of Furness—yet in each district at different times iron-ore working has been a significant cause of landscape change. Furthermore it is important to remember that dereliction is not a product of industrial contraction alone. It occurs also in areas of industrial prosperity where the adoption of speedier and more voracious methods of mineral extraction has greatly accelerated the rate of landscape change and potential dereliction. Many of the present-day opencast mineral workings must by law be restored to fruitful use and not be left derelict; but much derelict land survives, either as the legacy of past activity by industries now defunct, or as the recent creation of existing mineral workings. The continued growth of land devastation—recently estimated at 3500 acres per annum[5] exclusive of losses through subsidence—poses a most critical land-use problem, and warrants further examination.

The prevention of further extensive devastation falls under three main headings, each of which should be briefly examined: the reclamation and restoration of opencast mineral workings, the avoidance of surface sterilization by surface disposal of waste, and the mitigation of subsidence. In addition there are more complex problems of reclaiming land already derelict, and these should also be considered in outline.

The opencast working of minerals, notably ironstone, coal, sand and gravel, has greatly increased in volume during the past forty years or so, and with the exception of coal is likely to expand even more in the future. The restoration of opencast coal and ironstone workings is obligatory, in most instances for agricultural use. It has been shown by Dr G. P. Wibberley[6] that the complete restoration to agriculture of these workings is unprofitable, although reclamation of some kind is properly defensible on social and aesthetic grounds. Afforestation, as practised in parts of the Midlands after 1903[7] and without the expense of levelling and draining now involved in restoration, appears to offer a less costly way of restoring the amenity value of the former workings.

The in-filling of sand and gravel workings[8] is also held to be unduly expensive in itself, but when this can usefully be combined with the disposal of solid material—such as towns' refuse—the cost of reclamation may be offset appreciably. Thus many of the sand and gravel workings in the Lea Valley have been filled economically with town refuse from various parts of Greater London, where the pressure on available dumping space is so great that the use of sites as far away as the Fletton brickfields near Peterborough is being considered by local authorities. Less expensive and generally more profitable is the restoration to agriculture of dry sand and gravel pits which do not require filling, and the amenity use of wet pits for yachting, fishing, or water storage.

The surface disposal of colliery and other mineral waste poses one of the greatest and most controversial land devastation issues. Dereliction due to this practice still continues, particularly in coal-mining areas, in spite of the existence of alternative techniques of waste disposal. Even more disturbing is the fact that modern methods of packing spoil in the colliery workings as the mining faces advance are not automatically enforceable at entirely new pits. In the East Midlands the National Coal Board recently[9] revealed that although the underground stowage of spoil at its new Bevercotes and Cotgrave collieries was technically feasible, it was still considered to be economically impracticable. Underground stowage would add roughly £600,000 to the capital expenditure on the new pits (an increase of about 8 per cent) and would cost roughly 5s. od. per ton of saleable coal to operate (about one-third of the estimated profit per ton). The alternative suggested by the Board was the creation of extensive plateau-like spoil heaps reaching a height of 60 feet, and capable of eventual restoration, unlike the traditional conical tips of modern coal-mining areas. Clearly the resolution of this conflict between increased costs of mining on the one hand, and the loss of land and of amenity on the other, is of the utmost importance in determining the future policies of the N.C.B.

The third persistent source of devastation is subsidence, which again is largely a problem of coal-mining districts, but is also encountered in areas of ironstone mining and brine pumping.[10] Mining subsidence has frequently been the cause of parliamentary enquiry,[11] and of legislation primarily designed to clarify the processes of compensating the owners of damaged property.[12] In the majority of coal-mining areas the long-wall advancing, or total extraction method, has been adopted; with it subsidence equal to two-thirds the thickness of the coal removed can be expected, and it can affect the surface stability of areas that have not been worked under.[13] Subsidence progresses in a series of wavelike motions, slightly raising the ground in advance of the working face before it finally settles to its new level. The introduction of speedier mechanized mining has meant, however, "that with a deep seam and a reasonably rapid rate of advance large areas of coal can be worked out and the surface evenly let down without serious damage to surface structures".[14] Even so, damage due to subsidence will still occur in fault zones, at the "rib sides" of the area being let down, and in older workings which lie above the seams currently being mined at greater depth.

Prevention of subsidence is not possible if all the workable coal is extracted. The underground stowage of spoil will reduce, but not completely prevent subsidence,[15] for the only preventive measure is to leave supporting pillars of coal beneath selected surface features such as buildings, railways, and canals. Although certain structures have by law to be supported, the N.C.B. will normally accede to requests for support on payment of agreed compensation to the Board for the coal

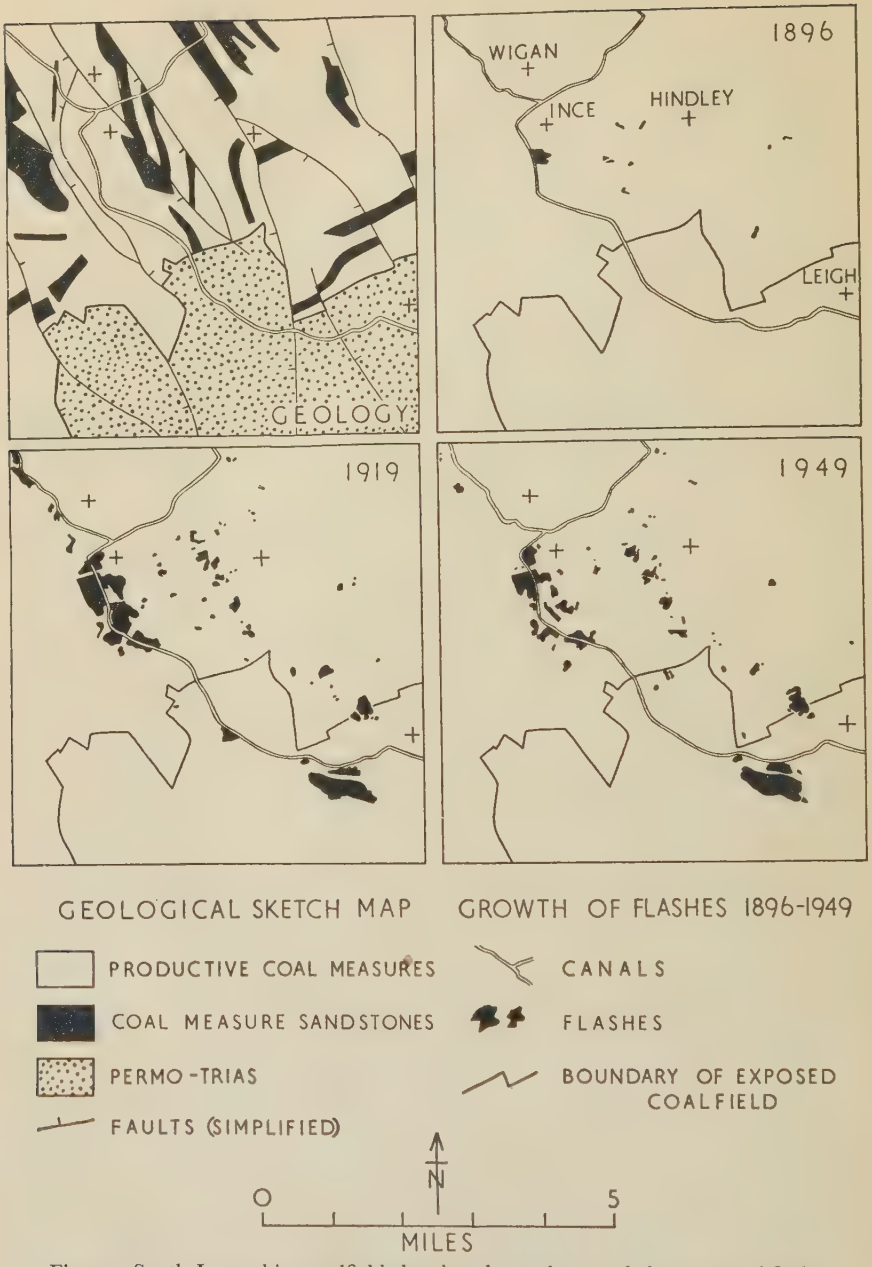

Fig. 1.—South Lancashire coalfield showing the geology and the extent of flashes in 1896, 1919 and 1949.

which has been sterilized in the pillars. The discussion of such compensation can, however, be protracted and may hamper surface planning; thus at Peterlee New Town the construction of much of the town centre was delayed by difficulties encountered in negotiating the compensation due to the N.C.B., which was finally fixed at £71,000

—£83,000 less than the Board had valued the coal.[16] There are many similar examples in which difficulties of co-ordinating surface and mineral planning are evident, so that subsidence impinges on the life of mining districts as a problem not only of reclamation but also of future development.

In many mineral-working areas the problems of dereliction are partly historical, and are made the more complex by the fact that defunct or moribund industries are less likely to provide capital for restoration than prosperous ones. The bulk of the cost of reclamation falls upon local authorities, with state aid principally for afforestation and industrial re-development. In many of the former Development Areas land devastated by earlier industries—such as iron manufacture at Merthyr Tydfil—has been restored to diverse industrial uses. Schemes of this kind are, however, exceedingly expensive—ranging from £600 to £12,000 per acre—and are never economic, although they may be socially desirable. Much derelict land has also been reclaimed for housing—notably in the Black Country—and for amenities such as parks and playing fields. Restoration of the latter kind varies markedly in cost, but often proves socially profitable. In at least one instance the cost of restoration could be set against the use of alternative sites for waste disposal and the construction of playing fields. This was at Welwyn Garden City, where a disused sand and gravel pit was filled by controlled tipping of towns' refuse to create an amphitheatre in which a sports stadium could be built. Not only were the mineral workings restored but other land that might have been used for refuse tipping and for playing fields was also spared.

To illustrate the evolution and character of some tracts of devastated land, and the problems which they pose, four examples have been chosen from areas that are perhaps not as well known as, say, the Black Country, and of industries that have not been as well served in geographical publications as, for example, sand and gravel or ironstone working. Of these areas three are on coalfields: Ince, South Lancashire; the Anker Valley, East Warwickshire; Moira, Leicester & South Derbyshire; the fourth, Wincham and Marston, is on the Cheshire saltfield.

The South Lancashire coalfield is dotted with the twin elements of coal-mining activity—subsidence lakes (flashes) and colliery spoil heaps. Fig. 1 shows the extent of the flashes at three stages in their evolution; it is noteworthy that between 1896 and 1919 great tracts of land were flooded, for by this time the longwall advancing technique of mining, which is highly conducive to subsidence, had become dominant in the area's collieries. The two zones of flashes trending from northwest to southeast between Wigan and Leigh form a distinctive element of devastation in the South Lancashire landscape. The growth of the flashes reflected not only the advent of the longwall advancing technique of mining, but also the topography and drift geology of the area. The southernmost group, which straddles the

boundary between the exposed and concealed coalfields, coincides largely with a so-called pre-glacial valley filled with drift and overlain by thick alluvium. The topography is gentle and the streams are sluggish, so that the disturbance of a delicately balanced drainage pattern by subsidence and spoil tipping rapidly produced permanent flooding on an extensive scale.

In this area the district immediately to the south of Wigan presents the most extensive spectacle of devastation (Fig. 2); most of the area depicted lies within Ince, an urban district with over 40 per cent of its surface area devastated and comprising in addition to the flashes and colliery spoil tips the abandoned site of an iron works which, it has been estimated, will cost more than £1,000,000 to reclaim.[17] The evolution of the industrial landscape of Ince clearly demonstrates both the rapidity of change and the scale of problems which dereliction brings in its wake.

In 1846 the area was still mainly rural; the canal was lined by pleasant farm- and park-land, some of it on the recently reclaimed mosses. Only at the pier head (one of many Wigan piers) did industry intrude upon the scene. To the east of the railway coal-mining was already evident at a number of small pits, but even here the industry was not yet dominating the landscape; extensive outcrops of Coal Measures sandstones (see Fig. 1) inhibited mining development. By 1892 the landscape had changed, although not as radically as those writers who spoke of it as a "waste Black Country"[18] implied. The small coal pits had been replaced by larger deep mines, and already the twin elements of devastation—the flashes and the spoil heaps—had appeared on the scene. The Coal Measures sandstones now inhibited subsidence and divided the flashes into two major zones.

In 1927 the landscape of Ince bore little resemblance to that of 1892, and even less to that of 1846. The scene was vividly portrayed by George Orwell in his polemic of the thirties *The Road to Wigan Pier*:[19]

> "I remember a winter afternoon in the dreadful environs of Wigan. All round was the lunar landscape of slag heaps . . . it seemed a world from which vegetation had been banished; nothing existed except smoke, shale, mud, ashes, and foul water."

The landscape today is only a little less Orwellian. The flashes have begun to recede as drainage is improved at their outlets by the removal of colliery spoil which blocks the watercourses and by deepening of channels in areas of impeded drainage on the mosslands farther north. Parts of the flashes have also been filled in by natural colonization of reed swamp, and by the deposition of colliery spoil, towns' refuse, and boiler ash from the thermal generating station which now occupies Westwood Park. But none of these changes has effected reclamation, for in most instances one type of derelict land has replaced another. The cost of reclaiming such an area would be prohibitive, and was even rejected during the thirties at a time of cheap labour.[20] The Lancashire County planning authority has investigated the problems

Fig. 2.—Ince, Lancashire, in 1846, 1892, 1927 and 1954. Data for 1954 based on field work. Note that in this and the following figures factory buildings are simplified.

of the area, and worked out some of the solutions on pilot sites elsewhere in the coalfield,[21] but the fundamental difficulty of financing reclamation in mining areas that are now moribund—lack of both local capital and incentive to restoration—has greatly retarded these ambitious plans.

The second area—the Anker Valley—lies on the north-eastern margin of the East Warwickshire coalfield.[22] The Coal Measures are

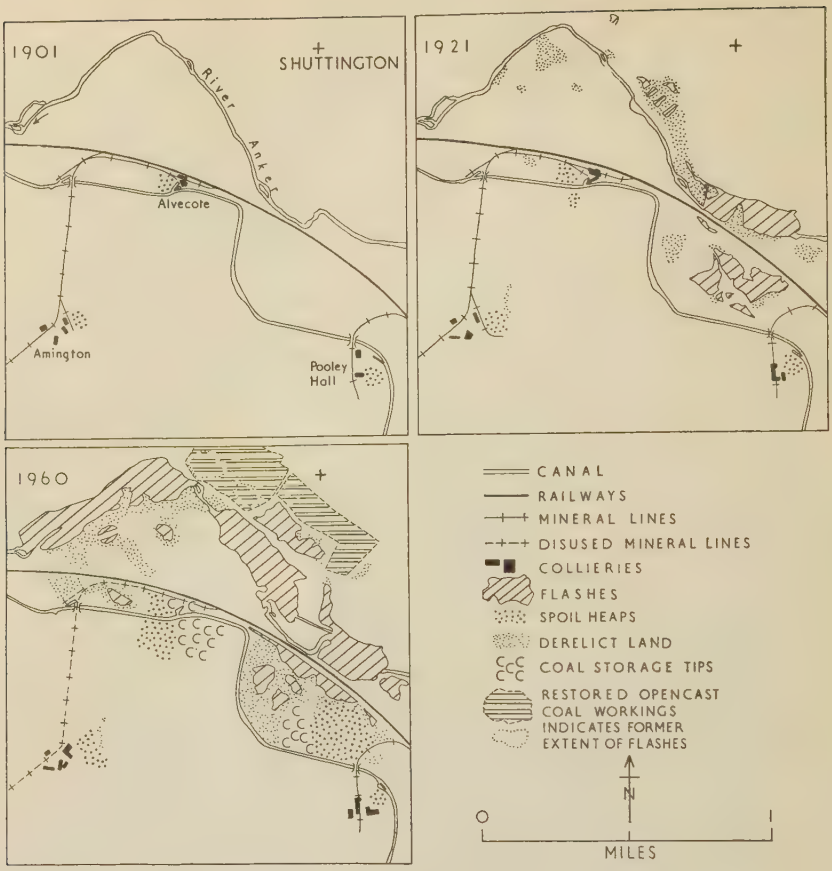

Fig. 3.—Anker Valley, East Warwickshire, in 1901, 1921 and 1960. Data for 1960 based on field work.

exposed in a narrow anticlinal outcrop, which trends northwest—southeast along the line of the river Anker. The eastern limb is much faulted and terminates abruptly against the Trias; the western limb dips beneath the unproductive Upper Coal Measures, and on this outcrop several pits were sunk during the nineteenth century, of which the North Warwickshire colliery—combining the workings of Pooley Hall and Amington pits—is the sole survivor.

The landscape bears many points of resemblance to that of Ince. The map (Fig. 3) shows how rapid was both the onset of flooding between 1901 and 1921 and its continuation thereafter: again, deep mining by the longwall advancing technique, beneath an area of thick superficial deposits, produced the optimum conditions for devastation. The area is interesting in that it also reveals the rapid readjustment of natural vegetation to changes wrought by subsidence and waste disposal. Parts of the locality reveal that during the space of less than sixty years there has been a sequence of events beginning with flooding, continuing with the re-colonization of the flashes by aquatic plants

which later gave way to rough herbage, and culminating in the growth of dense thickets of willow and alder. Similarly, the disused spoil tips at Alvecote colliery support strong stands of birch and less well-developed rough vegetation which appears to have established itself naturally.[23] In addition to this natural regeneration, parts of the area worked for opencast coal have recently been restored. In the spring of 1959 the opencast site to the west of Shuttington Church was still being worked; by December of the same year the workings had been levelled and re-seeded, and all that remains in the landscape to remind the passer-by of the earlier upheaval are the new wooden fences which partition the restored fields in a countryside where hedges are the usual boundaries. Thus the work of restoration can produce changes in the landscape with a rapidity that exceeds the pace of dereliction in the immediate vicinity.

Between the Anker Valley and Moira, which lies ten miles to the northeast, the broad tract of well-farmed country contrasts markedly with the industrial landscape at both extremities. Moira lies in the western basin of the Leicester–South Derbyshire coalfield,[24] and provides a noteworthy exception to the observation that "the Leicestershire industrial landscape nowhere attains . . . the dramatic and demented ugliness of the Potteries or the Black Country".[25] Moira owes its name and foundation as a mining settlement to Lord Rawdon, Earl of Moira, upon whose land coal pits were first sunk in 1804; the village was first built in 1811 and grew spasmodically as new pits were opened during the nineteenth century, towards the end of which the earthenware pipe and pottery industry became established locally, based on the extraction of the fine-grained clays of the Middle Coal Measures.

In 1921 industrial activity was fairly evenly balanced between clay working and coal-mining (Fig. 4). The clays were mainly dug from open pits, but in 1921 the Moira district was only just being fully exploited, mainly because the clays lay under a greater cover of overburden than they did to the north around Swadlincote, where the industry was of greater antiquity. By 1959 the expansion of the clay-working industries had transformed the landscape. This was partly due to the working out of clay farther north, but largely reflected the development of more efficient excavating and earth-moving equipment. Clay pits of depths exceeding 120 feet can now be worked economically, for overburden can be removed more rapidly and less expensively. Thus the landscape of clay working now comprises a series of large open pits surrounded by towering heaps of spoil and overburden. The overburden is kept until such time as restoration may be possible, but the lives of clay pits are long, and they become a semi-permanent feature of the industrial scene.

The growth of the clay industry has been paralleled by a partial contraction of coal-mining. The Rawdon-Marquis colliery is the only survivor of the original Moira pits, and in the fields nearby a new

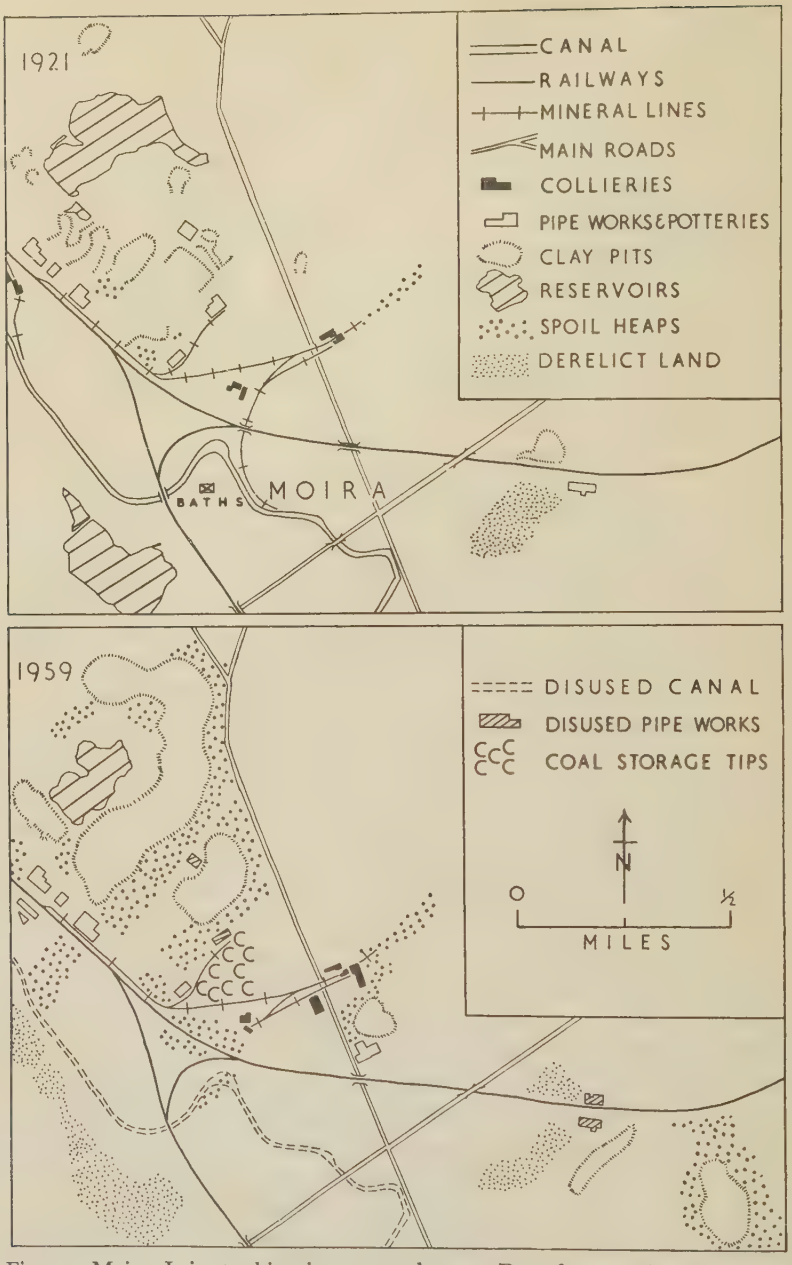

Fig. 4.—Moira, Leicestershire, in 1921 and 1959. Data for 1959 based on field work. The approximate areas of clay pits are shown.

feature of land use in mining districts has recently appeared—the dump of small coal for which no ready market is available (Fig. 4). Close to the colliery the local offices of the N.C.B. are housed in the Baths Hotel, which dates from the time in the nineteenth century when Moira had aspirations as a spa.[26] How different the outcome has been

can best be appreciated by seeing Moira as it now is, with the deep clay pits and mountainous heaps of spoil and overburden dominating the scene. The village mainly comprises long terraces of miners' houses of the nineteenth century, and municipal housing of a later date but scarcely more pleasing aspect. Damage caused by subsidence is evident in many of the houses and industrial buildings, and along the roads and the railway tracks. Thus the early ideal of a settlement that could be both a prosperous industrial centre and a fashionable spa perished, and the chaotic upheaval of mineral extraction gained the upper hand.

The fourth example provides a complete change of scene: the Cheshire saltfield possesses a unique range of land-use problems[27] and at Wincham and Marston (Fig. 5) their impact on the evolution of landscape can be fully appreciated. In 1877 these were prosperous manufacturing centres, with a large number of salt-works and salt-mines along the banks of the Trent and Mersey Canal. At that time subsidence was confined to the vicinity of some abandoned rock-salt mines to the west. However, the super-saturated brine of the flood-waters in these workings was needed to supply the deficiency of natural brine in the locality and by 1907 the pumping out of this brine had resulted in the caving in of the abandoned workings and extensive flashes had formed on their sites.

By 1959 the landscape had altered completely, and a new feature of the land-use pattern had emerged—the disposal of chemical waste from alkali works nearby. The salt industry had contracted almost to vanishing point, leaving a trail of derelict factory sites and abandoned mine shafts. The pattern of communications had also changed: a mineral railway serving the former salt-works and mines had been removed, the canal had been diverted to avoid further damage from subsidence, and the dirt track which precariously crossed the flashes had been replaced by a metalled road. In their new function as lime-waste reservoirs the flashes had been encircled by an embankment in order to increase their capacity, but in spite of this there were not enough derelict sites for waste disposal, and stable farmland also had to be used. In an attempt to avoid increasing the scale of dereliction in this way the chemical industry investigated alternative methods of disposal, and in 1953 a technique was perfected whereby the waste material could be discharged into the cavernous boreholes from which brine is abstracted by the controlled pumping method. Thus it is possible to stow waste underground and at the same time minimize subsidence risks without contaminating the great pillars of rock-salt which separate the boreholes. In addition attempts are being made to screen the abandoned workings of Wincham and Marston by tree planting, another evidence of the desire of a prosperous chemical industry to reduce or mitigate the impact of devastation on the landscape.

In these four studies of small areas an attempt has been made to show how the present industrial landscape has evolved, and to explain

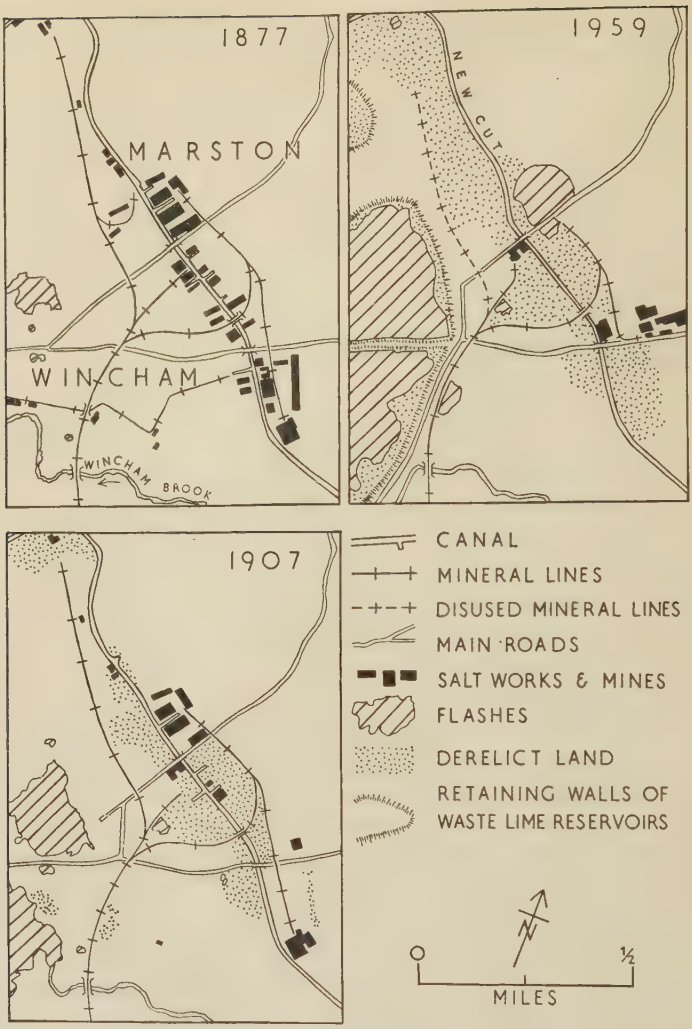

Fig. 5.—Wincham and Marston, Cheshire, in 1877, 1907 and 1959. Data for 1959 based on field work.

some of the salient features of the modern scene in terms of the land-use problems which they pose. It is clear that many of those facets of the "tortured industrial landscape" which we might ascribe to an unenlightened early Victorian policy of *Raubwirtschaft* are of relatively modern origin, and that some of them are the product of recent technological advance which has appreciably hastened the rate at which landscape changes can occur. It seems particularly unfortunate in the light of this that proved techniques of restoration or avoidance of devastation have not been applied with equal vigour, on grounds of high cost or inexpediency, and that only a few of the more prosperous branches of extractive industry have seen fit to improve the industrial environment which they help to create.

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[9] *The Times*, November 16th, 1959.

[10] For an account of the particular problems of brine pumping areas see *Minutes of Evidence*, Select Committee of the House of Lords, Cheshire County Council (Brine Subsidence) Bill, 1951–52; and *Minutes of Evidence*, House of Commons Committee, Cheshire Brine Pumping (Compensation for Subsidence) Bill, 1951–52.

[11] See for example *Report of the Royal Commission on Mining Subsidence*, Cmd. 2899, 1927; *Report of the Committee on Mining Subsidence*, Cmd. 7637, 1949.

[12] Bills such as the Coal Mining (Subsidence) Act 1957, 5 and 6 Eliz. 2 CH 59, attempt to clarify the confused legal position.

[13] For an explanation of the mechanics of subsidence see A. Coleman, "Land reclamation at a Kentish colliery", *Trans. Inst. Brit. Geogr.*, no. 21, 1955, p. 117.

[14] *Report of the Committee on Mining Subsidence*, Cmd. 7637, 1949, p. 6.

[15] Thus at Cadley Hill Colliery (South Derbyshire) underground stowage of waste will reduce subsidence from 10 to 3 feet.

[16] New Towns Act 1946, *Report of the Development Corporations* 1958–59, 1959, p. 319. Relations between the N.C.B. and the Development Corporation are governed by a Concordat, and there are quarterly meetings which attempt to co-ordinate surface and underground planning.

[17] This is the site of the disused Kirkless Hall iron and steel works, which lies on the banks of the Leeds and Liverpool Canal to the northeast of Wigan. For an account of derelict land in this area see J. L. M. Gulley and L. J. Smith, "Aufgelassenes Land, dargestellt am Beispiel der Grafschaft South Lancashire", *Die Erde*, vol. 91, 1960, p. 6 (in German with a brief English summary).

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[19] G. Orwell, *The Road to Wigan Pier*, London, 1937, p. 137.

[20] According to *Readjustment in Lancashire*, Manchester, 1938, a scheme of restoration which intended to make use of unemployed labour was shelved because it did not qualify as a training scheme for state financial aid.

[21] Suggested remedies and restorations, with comments by the County Planning Officer, appeared in *The Architectural Review*, vol. 118, 1955, nos. 707 and 708.

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[26] *Ibid.*, p. 73; the spa waters were also carried to the more salubrious neighbouring town of Ashby-de-la-Zouch. Moira was not unique—even Wigan had its "Harrowgate Wells" in the 1840s, only a little distance from the now devastated area of Ince.

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Decentralization in Metropolitan Boston

GERALD MANNERS

WITH THE CONSTRUCTION OF EXCELLENT HIGHWAYS radiating from cities, and the increasing use of road transport, the twentieth century has seen the explosion of the American Metropolis.[1] The essentially vertical city of the last century, compact and intensive in its land use, has been surrounded by a horizontal land-devouring suburbia; and, in the process, the old cities at the foci of contemporary metropolitan communities are losing some of their traditional strength as the unifying element within these regions.[2] These central cities at one time were the primary loci of population, industry and the whole range of service activities; but now they are being drained of some of their economic importance, as population and housing, manufacture,[3] wholesale trade and retail trade[4] respond to present-day centrifugal forces. The purpose of this paper is to explore some of these themes with particular reference to Boston, "the hub of New England".

The Boston Standard Metropolitan Area[5] today has a population of 2·4 millions.[6] The largest employer of labour is manufacturing industry, in which the five most important industries by size of labour force are electrical engineering, non-electrical engineering, food and kindred products, clothing and other finished goods, and printing, publishing and other allied products (see Table I). After manufacturing, the next largest employers of labour are the wholesale and retail trades, various government bodies and other service industries (see Table II). What is the distribution of these activities throughout the Metropolitan Area? What have been the magnitude and rate of changes in this distribution pattern in recent years? And, if there has been decentralization in the Metropolitan economy, has it affected equally all aspects of economic life?

Between 1947 and 1957 there was a significant decline in employment at the heart of the Metropolitan Area (see Table IV). In 1947 one in every four persons was employed "downtown" (see Fig. 1). This is an area of less than one square mile, which can be defined as the major business district of the city with an intensive concentration of retail trade, offices, service businesses, entertainments and hotels. By 1957 the proportion had fallen to one in every five; and the labour force of the downtown area had been reduced by over 7 per cent,[7] whilst that of the Metropolitan Area as a whole increased by 9·2 per cent. Downtown employment in manufacturing industry declined by 9000 jobs

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as industrial concerns, released from central city ties by the flexibility of both new energy supplies and road transport, rejected obsolete multi-story factory accommodation adjacent to water and rail terminals and moved to new, efficient, single-story factories on the urban periphery. Here were attractions of cheaper land, space for car parks, room for expansion, and lower taxes, all of which facilitated an increase

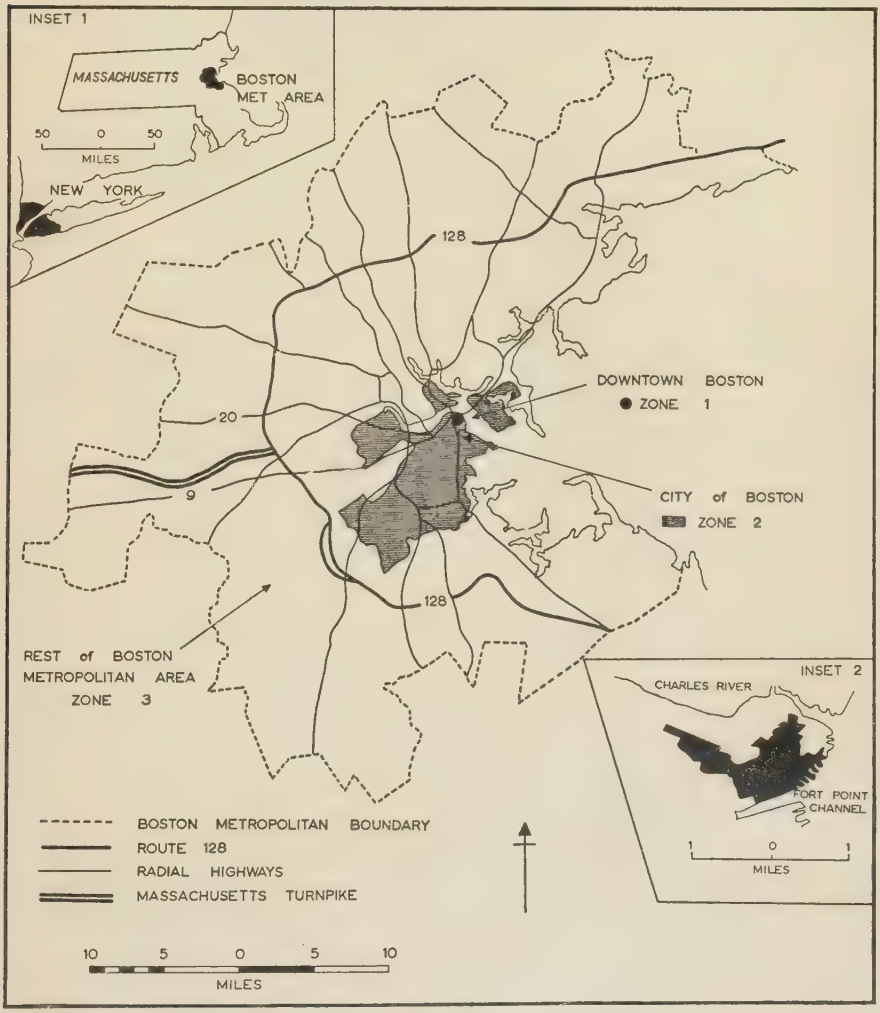

Fig. 1.—The Boston Metropolitan Area. Inset 1: Southern New England, showing the location of the Boston Metropolitan Area. Inset 2: Within the City of Boston, showing the extent of Downtown Boston.

in manufacturing employment by 20·4 per cent in the rest of the Metropolitan Area outside the City of Boston, i.e. Zone 3, during the decade. The trend in the location of wholesaling activities was similar, although less pronounced. As a result of the preference of many

wholesalers for a site within easy contact of both the downtown and suburban shopping centres, the 19·1 per cent decline in wholesaling employment in Zone 1 was not matched by a comparable decline in the rest of the City of Boston. However, the 43 per cent increase of employment in Zone 3 does represent a strong centrifugal location force in which the old multi-story warehouse is giving way to the extensive and highly mechanized single-story building for much the same reasons as have influenced industrial location.

Table I

EMPLOYMENT IN MANUFACTURING IN BOSTON METROPOLITAN AREA, 1957

Electrical machinery	53,500
Machinery (except electrical)	29,606
Food and kindred products	26,244
Clothing and other finished goods	24,370
Printing, publishing and allied trades	23,239
Leather and leather products	23,058
Transportation equipment	20,895
Fabricated metal products	16,398
Rubber products	12,665
Scientific instruments, photographic equipment, optical goods, watches and clocks	12,165
Paper and allied products	10,494
Chemicals and allied trade	9,853
Miscellaneous manufactures	9,169
Textile mill production	7,879
Primary metal industries	4,194
Furniture and fixtures	4,136
Stone, clay and glass production	2,664
Petroleum and coal	1,920
Lumber and wood products	1,833
Tobacco manufacture	220
TOTAL	294,502

Source: Massachusetts Division of Employment Security—the figures refer to the month of November.

Table II

EMPLOYMENT IN THE BOSTON METROPOLITAN AREA
(770 square miles)

Manufacturing	294,502
Wholesale and Retail Trade	234,175
Government workers (1950)	108,947
Service Industries	87,869
Self-employed workers (1950)	82,113
Finance, Insurance and Real Estate	68,766
Transport, Communications and Utilities	63,634
Construction	46,147
Agriculture and Mining	4,065
TOTAL	990,218

Sources: 1950 figures from U.S. Bureau of Census: all others, from Massachusetts Division of Employment Security, refer to November 1957.

It has been not only the downtown traffic congestion which has stimulated the growth of retail trade in suburban areas. The bulk of retail trade has always been of a local nature, and as population has spread out from the central city so has this trade moved with it. In

addition, the modern suburban shopping centre has positive attractions. For example, the "North Shore" Shopping Centre (see Fig. 2), located at the junction of two major highways within the Metropolitan Area and therefore highly accessible for a large suburban population, covers an area of 108 acres, has more than 50 stores, and has parking facilities for 8000 cars. Such developments as this have also contributed to the 25·6 per cent increase of retail employment in Zone 3 which stands in contrast to the declines in the other two regions.

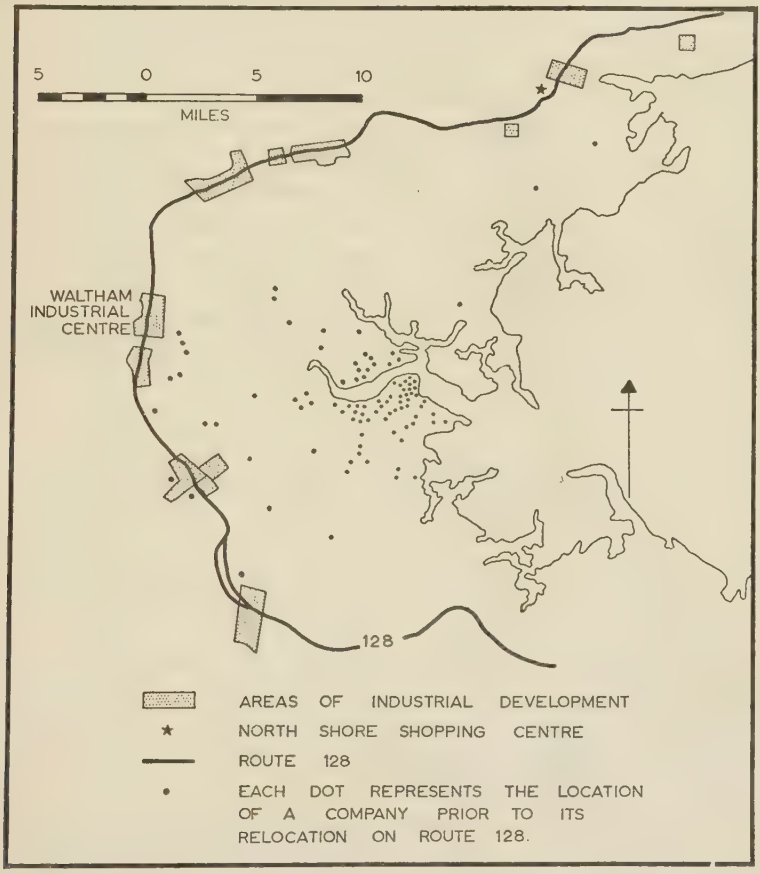

Fig. 2.—Route 128, showing areas of industrial development, and former locations of firms which have relocated there from within the Boston Metropolitan Area. (Source: Massachusetts Institute of Technology, *Economic Impact Study of Massachusetts Route 128*, Cambridge, Mass., 1958, pp. 2 and 20.)

The final category of employment which has declined downtown is construction activity: in spite of impressive downtown projects for highway development, new office accommodation and public buildings, the bulk of building today is in suburban areas and there is no need for a construction firm to maintain an expensive downtown location. "In sum, technological changes in transportation, manufacturing and goods handling along with the shift of population to the suburbs have

caused a major decline of downtown employment in manufacturing, wholesaling, retailing and construction."[8]

This process of decentralization is particularly well illustrated by recent developments along Route 128, a limited access, four- and six-lane divided highway, encircling the City of Boston some 10 miles from the centre. Although there were some pre-war beginnings to this 57 miles of "circumferential highway", the vital central link from Wakefield to Wellesley was not opened until 1951, and it is only from that date—when for the first time there was a continuous, high-speed route encircling the City and within the Metropolitan Area—that there began one of the major economic developments in post-war New England. Since 1951, the low-value land of chicken and truck farms through which the route was built has been transformed into a series of booming and extensive industrial and commercial developments; between 1951 and 1957, employment in new plants within one mile of the road reached 17,000, and by the end of 1959 the figure had risen yet further to approximately 30,000.[9] This expansion of employment represents a considerable proportion of the growth which has occurred in the Metropolitan Area as a whole; in 1957, for example, it has been estimated that 38 per cent of Boston's new business development was along Route 128.[10]

Table III

PERCENTAGE DISTRIBUTION OF NUMBER OF PLANTS, INVESTMENT AND EMPLOYMENT BY TYPE OF ENTERPRISE ON MASSACHUSETTS ROUTE 128 IN 1957

Type of Enterprise	*% of Number of Plants*	*% of Investment*	*% of Employment*
Manufacturing	40·6	65·8	72·6
Distribution	43·7	21·1	11·7
Research and Development	9·4	9·2	12·7
Service	6·3	3·9	3·0

Source: Massachusetts Institute of Technology, *Economic Impact Study of Massachusetts Route 128,* Cambridge, Massachusetts, 1958, p. 13.

It is significant that 72·6 per cent of the workers along Route 128 were engaged in manufacture in that same year, whilst a mere 11·7 per cent, 12·7 per cent and 3 per cent of the total employment were found in distribution, research and development, and various service industries respectively (see Table III); for these figures[11] reveal the particularly strong attraction which a peripheral metropolitan location has for manufacturing as opposed to other economic activities. It is also noteworthy that 78 per cent of employment was in firms which had relocated from other parts of the Metropolitan Area; the greater number of these firms previously had a location towards the centre of the City of Boston (see Fig. 2), and they represent a positive decentralization process rather than an increment to manufacturing at the

urban periphery or regional industrial growth. A third, and important, point about Route 128 developments is that the businesses are tending to concentrate along the central—i.e. at the most accessible—section of the highway, close to radial Routes 9 and 20 and at its junction with the Massachusetts Turnpike. This fact hints at one of the reasons why the firms were located adjacent to the road. "One predominant factor which can be singled out as motivating the move of industries to Route 128 in preference to another location is the common desire of a regional access, implying freedom from traffic and parking congestion prevalent in the intown areas."[12] Although this factor may have predominated in decisions, there were further reasons given by the firms for their move to the circumferential highway; frequently quoted were the need for land for expansion, the labour market and the employee accessibility which were provided by the route, the commercial accessibility and the attractive nature of sites there, and the advertising value of having a Route 128 location. Additional reasons were the facilities for large car parks, low land costs, the advantage of "package deals",[13] urban congestion and lower taxes.[14] Quite obviously the nature of the enterprise would affect the relative importance of these factors, and something of this can be seen in Table V.

Route 128 may have an element of uniqueness by virtue of its particularly rapid development, yet it does serve to illustrate effectively contemporary events and trends on the periphery of the Boston Metropolitan Area, and all Metropolitan communities for that matter. In addition to the industrial and commercial developments which have been noted already, there has been a move of the employees of Route 128 firms out towards the highway[15] and their new workplaces. Thus, there has been created a situation in which the labour force and the new businesses act and react upon each other to accelerate the decentralization process. And they bring further developments with them, for, in addition to the industrial and commercial progress along the highway, two shopping centres have been built and a third one is under construction; also, a recreation area is projected for the near future, as well as an entertainment centre.

These, then, are contemporary events at the Metropolitan periphery —and there is planned a second circumferential highway some 15 miles further out, Massachusetts Route 495, which will eventually serve to accelerate these developments—but they are only part of the Metropolitan picture. Reference to Table IV shows that besides the downtown decline of employment opportunity in manufacturing, wholesaling, retailing and construction activities, there are some employment categories in which there have been significant gains during the post-war years. The number of "white collar workers" has increased by 8500; banks, finance houses, credit agencies and investment trusts, insurance firms, brokers, advertising agents, engineering

Table IV

EMPLOYMENT IN BOSTON, 1947 AND 1957*

	Zone 1: Downtown Boston			*Zone 2: The rest of the City of Boston*			*Zone 3: The rest of the Boston Metropolitan Area*			*The Boston Metropolitan Area as a whole*		
	1947	1957	% *Change*	1947	1957	% *Change*	1947	1957	% *Change*	1947	1957	% *Change*
Manufacturing	35,589	26,540	−25·4	75,744	64,365	−15·0	170,611	205,403	20·4	281,944	296,308	5·1
Wholesaling	26,029	21,064	−19·1	25,500	29,500	15·9	17,024	24,337	43·0	68,553	74,951	9·3
Retailing	40,832	35,766	−12·4	51,045	44,540	−12·7	66,415	83,387	25·6	158,292	163,693	3·4
Construction	9,390	6,508	−30·7	10,906	11,906	11·1	20,728	30,084	45·1	40,836	48,498	18·8
Finance, Insurance and Real Estate	36,505	41,613	14·0	8,337	12,710	52·5	10,183	13,766	35·2	55,025	68,089	23·7
Business and Personal Services	23,471	26,166	11·5	23,477	26,188	11·8	27,943	36,421	30·3	74,891	88,775	18·5
Transport, Communications and Public Utilities	17,468	18,508	6·0	17,909	21,872	22·1	20,989	23,524	12·1	56,366	63,904	13·4
Other Employment	1,164	479	−58·8	1,508	1,594	0·6	1,971	2,623	33·1	4,643	4,696	0·1
TOTAL	190,448	176,644	−7·2	214,238	212,725	−0·7	335,864	419,545	24·9	740,550	808,914	9·2

* These figures only refer to those workers affected by the Massachusetts Employment Insurance Law, and therefore omit Government employees and self-employed workers, who together contributed 191,000 to the Metropolitan Area's workforce in 1957.

Source: Greater Boston Economic Study Committee, *A Report on Downtown Boston*, Boston, 1959.

consultants and business consultants, architects and lawyers have all increased the size of their staffs, and in addition there was a small increase in transport workers, together with a significant increase in telephone and telegraph employment. Unrecorded on the table is the increase of government employment of which no figures are available.

But the categories of increasing employment to be seen in Table IV do not tell the full story of downtown employment trends, for there are certain kinds of economic activity which are included in the declining groups yet which nevertheless have tended to maintain themselves—or even increase their activity—at the centre of the Metropolitan Area. Within the manufacturing industries, for example, publishing and clothing firms declined more slowly than the average, with the result that they accounted for 70 per cent of all downtown employment in manufacturing in 1957.[16] And within these two industries there are two activities, women's exterior clothing and commercial printing, which have manifested a particularly strong preference for central business district locations. This is because they are concerned with unstandardized products and are constantly presented with, and must react quickly to, changes in style and taste (all of which demands a close and regular contact between buyers and sellers) which can best be satisfied in a downtown location. Similarly, wholesalers of unstandardized products show small inclination to leave a central location (employment in the furniture and house furnishing wholesale trade actually increased by 50 per cent during the decade), and certain types of retailing have proved to be exceptions to the general rule; the sale of jewellery and other luxury articles, very specialized shops retailing such articles as cameras and clothing and catering especially for the "captive" market of the daytime working population, and big stores with a wide range plus a large stock of consumer durables make up the greater part of the exceptions.

Present plans for the redevelopment of central Boston endorse the general downtown trends which have already been noted. On the site of the disused Boston and Albany Railroad marshalling yards an insurance company, Prudential of America, is undertaking a 31-acre redevelopment for both office and residential purposes; and plans for a new Federal, State and City government centre covering another 32 acres, and for a smaller area of commercial redevelopment, have been adopted officially. An interesting suggestion has been made[17] that modern accommodation should be provided in redevelopment for those industries which would appear to have a propensity for remaining downtown, especially since many of the businesses attracted to a central location are small in both scale and capital resource. Many of their activities are at present pursued in old and inadequate buildings, and it is argued that, unless help is given to make available better accommodation, these firms will find it necessary eventually to leave a downtown location. Four redevelopments are proposed: these are a new

Table V

PERCENTAGE NUMBER OF PLANTS AND TOTAL EMPLOYMENT, AND PERCENTAGE DISTRIBUTION OF EMPLOYMENT IN TYPE OF ENTERPRISE BY MAJOR FACTORS AFFECTING SITE SELECTION ALONG ROUTE 128

Factors considered in site selection	*% number of plants*	*% of total employment*	*% of manuf. employment*	*% of distn. employment*	*% of research and development employment*	*% of service employment*
Land for expansion	50	68	72	53	67	75
Labour market	32	61	63	13	97	87
Employee accessibility	37	56	53	27	97	77
Commercial accessibility	69	54	54	72	43	20
Attractive site	24	53	57	4	77	75
Advertising value	30	44	47	17	64	12
Parking space	21	26	26	12	43	5
Cost of land	22	17	15	20	17	75
"Package Deal"	19	14	11	20	26	7
City congestion	21	14	6	32	41	5
Lower taxes	10	13	14	24	0	0
Commercial market	21	7	4	32	0	2
Railway facilities	9	5	5	12	0	0
Potential value increase of site	8	1	0	6	0	0
Other	3	2	0	4	0	9

Source: Massachusetts Institute of Technology, *Economic Impact Study of Massachusetts Route 128*, Cambridge, Massachusetts, 1958, p. 32. The figures refer to answers given by representatives of ninety-nine new industrial and commercial plants located on Route 128 in September 1957.

downtown office centre, a "Decorative Arts Centre" for wholesale dealers in fabrics, carpets and quality furniture, a "Women's Apparel Centre" for both manufacturing and wholesale activities, and a "Graphic Arts Centre" for typesetters, engravers, platemakers, stereotypers, printers, lithographers and bookbinders.

In sum, then, all is not lost for the centre of the Boston Metropolitan Area. Of course, as has been observed frequently, the centres of cities are having difficulties in adjusting to their changing roles in the mid-twentieth century for such reasons as their congested and inadequate road systems, or the high value of central business district land which (together with the multiple ownership and interests therein) makes substantial redevelopment difficult for the individual property owner. In these matters Boston is no exception. Nevertheless, what is significant is that the centrifugal forces acting upon the economic geography of the Boston Metropolitan Area as a whole are not influencing equally the total spectrum of economic life within it. Whilst there is a strong trend towards the decentralization of manufacturing, wholesaling and retail trade generally, certain activities within these broad categories retain their preferences for central locations; and these activities should be associated with a wide range of office employments, together with jobs in transport and communications, in so far as they continue to be subject to centripetal influences and keep the heart of the Metropolitan Area very much alive.

REFERENCES

[1] See The Editors of Fortune, *The Exploding Metropolis*, New York, 1957, especially Chapter 5.

[2] Of the many publications on this theme, see especially Donald J. Bogue, *The Structure of the Metropolitan Community: A Study of Dominance and Subdominance*, Ann Arbor, 1949.

[3] E. M. Kitagawa and Donald J. Bogue, *Suburbanization of Manufacturing Activity Within Standard Metropolitan Areas*, Oxford, Ohio, 1955.

[4] See Murray D. Dessel, *Central Business Districts and their Metropolitan Areas: A Summary of Geographic Shifts in Retail Sales Growth*, 1948–54. Area Trend Series, No. 1, U.S. Department of Commerce, Washington, 1957.

[5] See K. C. Klove, "The definition of Standard Metropolitan Areas", *Economic Geography*, vol. 28, April 1952, p. 95.

[6] As of January 1st, 1955, the population of the Boston Metropolitan Area was 2,396,016: see Massachusetts Departments of Commerce, *Monograph for the Boston Metropolitan Area*, Boston, 1958.

[7] This percentage should undoubtedly be qualified by the increased number of government employees—of whom no figures are available—in the downtown area during the decade.

[8] Greater Boston Economic Survey Committee, *A Report on Downtown Boston*, Boston, Massachusetts, 1959.

[9] Robert T. Killam, Jr., *Boston's Golden Industrial Semicircle*, Special Supplement of *Greater Boston Business Magazine*, 1959, p. 1.

[10] Massachusetts Institute of Technology, *Economic Impact Study of Massachusetts Route 128*, Cambridge, Massachusetts, 1958, p. 26.

[11] *Ibid.*, p. 13.

[12] *Ibid.*, p. 191.

[13] This refers to a situation in which a real estate promoter provides an entrepreneur with not only land but also a prepared site, a building to specification, and the necessary utilities. These facilities may be bought outright, or leased, with an option to buy at a later date.

[14] Massachusetts Institute of Technology, *op. cit.*, p. 31 ff.

[15] *Ibid.*, pp. 65 and 66.

[16] Greater Boston Economic Study Committee, *op. cit.*, Table 5: they accounted for 64 per cent in 1947.

[17] *Ibid.*

A View of Foreign Lands

JOHN HADDON

THE IMAGE OF AUSTRALIA is that of an aborigine, armed with a boomerang, chasing a kangaroo over a vast desert to the sounds of the bleating of innumerable sheep and the whistle of countless missiles, while in the far distance gleams Sydney harbour bridge. Fair dinkum!

America is different. America is a country of remarkably developed, highly polished young women, and oddly garbed, criminally inclined young men travelling at great speed in monstrous cars along super-highways from one skyscraping city to the next; the very largest cars contain millionaires with crew-cuts; everyone is chewing gum.

France. Ah, France! She consists of the Eiffel Tower, the Folies Bergères (which no-one can spell), Christian Dior, and the Riviera. Upon her lives a race of fickle, excitable, politically obsessed people who dine and wine themselves magnificently, wearing berets, in the midst of unmentionable plumbing; and over all looms de Gaulle.

South Africans break off from the Boer War to eat oranges, make fortunes from gold and diamonds, and oppress natives, under a government as merciless as the ever-present sun.

Or such is the consensus of opinion in my geography classes. What is the consensus in yours?

Much of this material is not found in the usual geography text-book, and I wanted to find what were, in fact, the things about foreign countries which the children found memorable, and what sort of general impression they had of the countries they studied in class. I also hoped to classify the details they gave into "knowledge acquired in the classroom" and "knowledge gained elsewhere".

Unfortunately the simple method I used did not give results which could be clearly divided in this way because I made *one* investigation—some time after the country had been studied—instead of *two*, one before and one after; many of the items could have been remembered from either classwork or from outside experiences and it would have been unsafe to make a distinction. However, the results which I got I found of great interest and they have had an effect on the way I now approach my teaching. I therefore thought that they might be of interest to other teachers and point the way to further and more detailed investigation. I am sure that it is vital for established teachers frequently to question their methods.

Every boy and girl in four forms (average ages 13, 14, 15, 16—the last the G.C.E. (O) Form) was asked in a 30-minute period of supervised silent preparation (this is a boarding school) to write down in short

➤ Mr. Haddon is geography master at Sidcot School, Winscombe, Somerset.

phrases, or single words, the thoughts and images which were conjured up by the name of a particular country. In each case the country had recently been studied. There was no limit to the number of things to be mentioned; the average was about 30. The results were studied and a possible classification worked out. The number of mentions in each category, with approximate percentages of the whole, were as follows.

Class	IV_2		IV_1		V_2		V_1	
Average age	13		14		15		16	
Category of Points Mentioned	*Australia*		*U.S.A.*		*S. Africa*		*France*	
		%		%		%		%
1. Architecture	16	2·3	75	6·9	4	1·1	50	10·7
2. Transport	28	4·1	116	10·6	16	4·3	41	8·8
3. Landscape	92	13·3	92	8·4	38	10·2	26	5·6
4. Climate	38	5·5	9	0·8	24	6·5	13	2·8
5. Social	102	14·8	282	25·9	74	20·0	193	41·4
6. Political	0	0	21	1·9	10	2·7	14	3·0
7. Military	0	0	18	1·6	0	0	6	1·3
8. Scientific	7	1·0	56	5·1	0	0	3	0·6
9. Economic	0	0	13	1·2	1	0·3	14	3·0
10. Entertainment	0	0	130	11·9	0	0	37	8·0
11. Human types	24	3·5	53	4·8	11	3·0	11	2·4
12. Fauna	98	14·2	26	2·4	31	8·4	0	0
13. Flora	45	6·5	6	0·5	17	4·6	0	0
14. Farming	99	14·4	97	8·9	28	7·6	29	6·2
15. Industry and mining	40	5·8	52	4·7	55	14·8	10	2·1
16. Literature	5	0·7	7	0·6	6	1·6	1	0·2
17. Historical	12	1·7	26	2·4	34	9·2	4	0·9
18. Place names	84	12·2	15	1·4	21	5·7	14	3·0
Total	690		1094		370		466	
Number in class Boys	20		22		12		20	
Girls	12		25		24		15	

The following are some of the points most frequently mentioned. The list is by no means exhaustive, but illustrates the classification; the numbers indicate the category of the point mentioned.

U.S.A.

1. Skyscraper. 2. Super-highways, high powered cars, some reference to large trains and big ports, none to air-lines. 3. Great Plains, Rockies, desert. 5. Chewing gum, jeans, crew-cuts, baseball, labour-saving devices, high standard of living, "Teddy-Boys" (used loosely as a term to describe gangs of juvenile delinquents). 6. World position, especially as regards Russia. 8. Mainly atomic missiles (included here rather than under the Military section). 10. Hollywood, television. 11. Negroes, Indians, millionaires. 17. Civil War.

Australia

1. Sydney harbour bridge. 3. Grasslands, desert. 5. Cricket, swimming. 8. Woomera. 11. Aborigines.

France

1. Eiffel Tower, Champs Elysées, Versailles, châteaux. 2. Electric trains, cobbled streets, small cars. 3. Riviera coast, Alps, tree-lined roads. 5. Food, bad plumbing, clothes. 6. Rapid changes of government, de Gaulle. 10. French films, cabaret.

S. Africa

3. Veld, Table Mountain. 4. Sunshine. 5. Apartheid. 17. Boer War.

In looking at these figures one should bear in mind certain facts.

1. The first named thing is not necessarily the most important, or the most firmly fixed. The starting point of a chain of recollection is often determined by a fortuitous circumstance. It is therefore necessary to take *all* the points mentioned.

2. Some children will endeavour to please by deliberately searching for lesson material to include, others will deliberately avoid such material; some will be lazy, others zealous. The larger the number of people, the less will these special cases affect the general result. It was explained that this was not a test and would not count for marks; this did not appear to encourage irresponsibility.

3. Too narrow a classification atomizes the results and prevents the drawing of general conclusions. Too broad a classification oversimplifies and masks significant deviation.

4. These particular children vary widely in intelligence but most come from fairly well-informed homes. All share the same geography teacher. The value of a survey such as this is limited unless it can be compared with results from other groups.

In general, the items were more accurate than was expected and there were few completely incorrect statements. There were hardly any attempts at facetiousness; the work was treated seriously and the children had grasped the idea of what they were asked to do. On the whole, the girls were far more interested than the boys in domestic details such as clothes and housing, while the boys were more interested in sport and scientific achievement.

Some of the more obvious inferences that may be made from the results are as follows:

1. After the age of 13 the recital of place names becomes far less important. This is accompanied by a greater understanding of geography and by an increased interest in historical and political factors.

2. In all sections, social facts predominate. These are facts relating to the way of life of the people of the country, apart from those which refer to specific economic activities, such as farming, industry and entertainment (sport is classified here with social, rather than entertainment factors). The proportion of social facts would be smaller, but still dominant, if all the answers had been from boys. The facts in the social group are not, on the whole, learnt from geography lessons.

3. Farming appears to make a greater impression than industry.
4. Architecture and transport interest mainly as social rather than economic factors.
5. On the whole, physical geography does not rouse great interest except in its effect on man.

To return to the images with which we started. Their importance is that they stress the fact that what interests children is people and the way they live. This is not a surprising or a new thought, but to the teacher of geography it is an important one. These findings from an admittedly crude and simple experiment emphasize that to the children concerned the order of interest, understanding, and recall, was Folk, Work, Place. The approach they best understand is a description of how people live, followed by a search for the underlying factors which help to account for that particular way of life. This is the more interesting because, until now, their teacher has, in the main, worked the other way round.

It seems then that *memorable* work would be concerned more with people than with places. But would it be geography?

This Changing World

BRITISH STEEL TUBE PRODUCTION

Although only some seven per cent of Britain's crude steel output is diverted to the production of steel tubes, the industry's importance to the national economy can be measured by the fact that steel tubes and fittings form the largest export of any steel product. Approximately two-fifths of the annual output is exported, much of it pipelines for the oil and natural gas industry. It is the spectacular advances in the exploitation of the world's oil reserves, rather than increased demand for tubes for general structural or domestic uses at home, that has accounted for a doubling of steel tube production in Great Britain, from 750,000 tons in 1946 to almost $1\frac{1}{2}$ million tons in 1960.

The installation of new or additional plants of high capacity during the post-war period has brought about a change in the geographical pattern of tube production. Exact mapping, however, is hindered by lack of detailed statistics. The British Iron and Steel Federation publishes figures only on a District basis, and since 1956 has omitted tubes over 16 inches in diameter, but an approximate guide to the changing pattern of production can be gained from a study of plant location and difference in District output after 1956. (Fig. 1 (a), (b).)

Of the three leading producers, Stewarts and Lloyds and the South Durham Steel and Iron Company specialize in the larger sizes of product, whereas Tube Investments Ltd. concentrate mainly on smaller and more precision tubing. The different specialization is reflected in the disparity between number of plants and output by District. No fewer than 29 of the 37 tubeworks are concentrated in two areas, the West Midlands between Wolverhampton, Stourbridge and Erdington, and the Glasgow area—localized patterns which have evolved from the early and diverse metallurgical industries of the two areas. Many of the works in the West Midlands District are engaged in the production of smaller tubing—9 of Tube Investments' 12 plants are in this area—so that there is a low average output per plant, while the change in form of published figures since 1956 has little affected the District total which is at present just over 400,000 tons.

The Scottish District has shown a continual post-war increase and production is double that of 1946. Four of the six plants belong to Stewarts and Lloyds, the largest of which is the Clydesdale (Mossend) works, an integrated plant which as a result of extensions in 1948 and 1956 has a capacity of just over 200,000 tons.

The output of the two traditional areas or Districts is now exceeded by the south-eastern District in which there are only two tubeworks, at Chesterfield and Corby. The former is overshadowed by the Stewarts and Lloyds plant at Corby. Located on the Northamptonshire orefield and integrated as part of a large iron and steel works, the plant was opened in 1935 and is the largest single tubeworks in the country. Post-war production has risen from 200,000 to over 500,000 tons, which represents one-third of the national output.

Three other Districts, each containing two plants, have smaller outputs. The Yorkshire District is the least important of the three. The North-East is notable for a large rise in production after 1955 as a result of expansion of the South Durham Steel and Iron Company's works at Stockton, originally opened in 1926. The plant, which is supplied with plates from the Company's steelworks at West Hartlepool, produces tubes up to 40 inches in diameter and has a capacity approaching 200,000 tons a year.

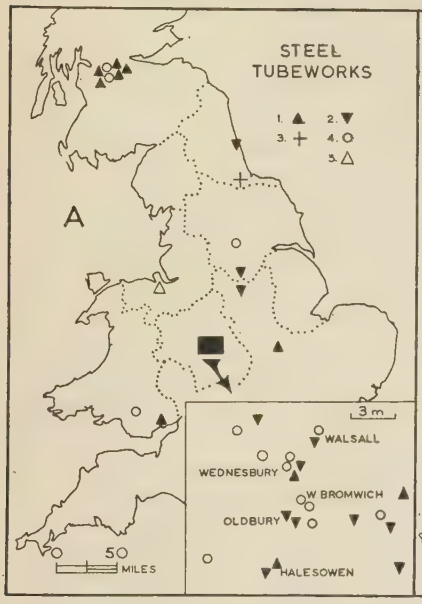

Fig. 1 (a)

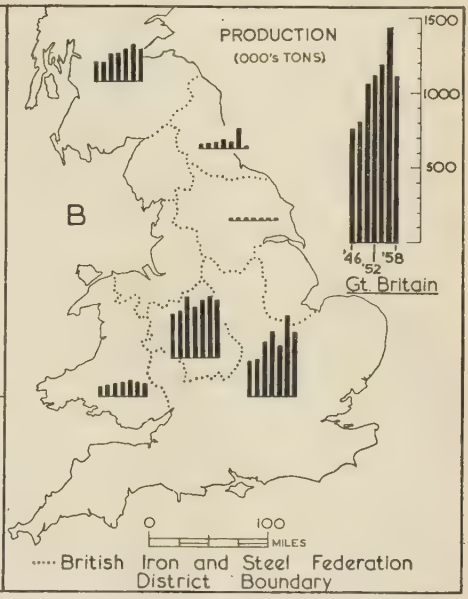

Fig. 1 (b)

Fig. 1.—(a) Distribution of British steel tubeworks, 1960: 1—Stewarts and Lloyds; 2—South Durham Steel and Iron Co.; 3—Tube Investments Ltd.; 4—Other; 5—Stewarts and Lloyds under construction. (b) Steel tube production by Districts, 1960. (Source: *Annual Report*, British Iron and Steel Federation.)

The most recent development, again stimulated by the demands of the oil industry, is the creation by Stewarts and Lloyds of a new tubeworks at Shotton on a site adjacent to the steelworks of John Summers and Son, Ltd. from which it will be supplied by cold steel strip. The plant, of capacity 250,000 tons, will be completed by the end of 1960. It will therefore cause a further disparity between the District patterns of tubeworks and steel tube production.

Loughborough Training College D. C. D. Pocock

ECONOMIC REGIONALIZATION IN BULGARIA

In recent years the concept and study of regional economies has been attracting attention amongst economists and economic geographers, notably in North America. In the U.S.S.R. the topic has recently come to the fore in connection with the government decision to carry out a scheme of

administrative decentralization involving the dissolution of a number of ministries concerned with economic affairs and the transfer of most of their work to new "administrative-economic regions". Functional economic regions of an all-embracing character and with precisely demarcated boundaries have thus been deliberately created. The example of the U.S.S.R. is now being followed in the countries of "People's Democracy" in Eastern Europe. It should not be overlooked, however, that an abolition of detailed economic control from the centre along somewhat different lines took place in Jugoslavia some years ago.

Administrative changes on the Soviet model were introduced in Bulgaria in 1959, although it is true that the question of delimiting economic regions had been the subject of discussion for several years, and a special commission had been set up in 1956. Bulgaria prides itself on achieving the closest possible imitation of the Soviet system, a recent goverment policy statement declaring that "our socialist state, regardless of our country's historical traditions and peculiarities, will develop precisely along the road of the Soviet Socialist state". Virtually one hundred per cent collectivization of the land has, for instance, been achieved ahead of all the other countries of Eastern Europe; not only this, but an amalgamation of the co-operative farms themselves to form even larger units took place in 1958 following on the Soviet precedent, the total number of farms being reduced from over 3000 to under 1000, each covering on average an area of about 11,000 acres.

As in the U.S.S.R. the setting up of economic territorial units is considered to be necessary in the interests of efficiency, while on ideological grounds the change can be justified by invoking the Leninist principle of "democratic centralism". This, according to Zhivkov, First Secretary of the Bulgarian Communist Party, "combines central leadership on the main questions with the maximum development of the initiative of the local organs and the masses, with the ever fuller participation of the working people in administration and economic management". It should be noted, however, that the new economic regions of Bulgaria are very much smaller in scale than those of the U.S.S.R., although admittedly these themselves show very wide differences in area and population. Bulgaria taken as a whole (43,000 square miles and 7·6 million inhabitants in 1956) is the rough equivalent of only two or three Soviet economic regions with broadly similar environmental and economic characteristics, such as those of the Ukraine outside the Donbass.

It is not clear what criteria were used in delimiting the new regions, nor the extent to which economic geographers were consulted, but it is known that a strong body of opinion amongst geographers would have preferred far fewer units than the total of thirty which was decided on by the government. At a conference on economic regions held in 1953 individual geographers suggested totals as low as three, five and seven. Despite this failure to influence the government on the question of the most appropriate regional division of the country, research by economic geographers nevertheless seems to have been of value in connection with the general problem of economic reorganization: for instance, during a visit to the Geographical Institute of the Academy of Sciences in 1958 the present writer was shown work on uneconomic cross-hauls of materials.

Hitherto Bulgaria has had a highly centralized economic system based on a chain of authority extending downwards from central ministries through head offices to individual enterprises. At the same time conventional local government functions were carried out on the basis of thirteen *okrŭgs*, each split into several *okoliyas*, with these in turn including urban and rural *obshtinas*. Under the new system several ministries dealing with economic affairs have been abolished and thirty new administrative-economic *okrŭgs* have been set up, which are thus smaller in area than the thirteen old *okrŭgs*. The *okoliyas* have disappeared, but the *obshtinas* remain, although reduced in number by about one half, to under 1000, to take account of the amalgamation of the co-operative farms and their associated villages. The capitals of the new *okrŭgs* are usually centrally placed towns of existing regional importance, although in certain instances they are peripherally located when no other suitable centre exists. The three largest cities, Sofia, Plovdiv and Varna, together with their immediate hinterlands, form separate *okrŭgs*, while each city is also the headquarters of an extensive "rural" *okrŭg*.

Bulgaria—new Economic Regions, 1959.

The most populous *okrŭg* (1956 population 713,000) is that of Sofia itself, which takes in the whole of the city (645,000) as well as some surrounding villages. The other two "urban" *okrŭgs* have much smaller numbers—Plovdiv city 162,000, *okrŭg* 256,000, and Varna city 120,000, *okrŭg* 125,000. The remaining twenty-seven *okrŭgs* have populations of between 144,000 (Smolyan) and 348,000 (Burgas). Their capitals range in size and importance from Smolyan (5100), situated in the Rhodope Massif in a tributary valley of the River Arda, to leading provincial towns such as Ruse (83,000), the chief port on the River Danube, Burgas (73,000), the second port on the Black Sea coast, and Dimitrovo (formerly Pernik,

60,000), Bulgaria's heavy industrial centre and brown coal-mining town, situated some fifteen miles south-west of Sofia.

Despite the rapid growth of non-agricultural employment in recent years as a result of the greater exploitation of mineral resources and the creation of new industries, it seems likely that agriculture will still play a leading role, at least in terms of numbers employed, in most of the *okrŭgs* outside the three large cities. Even the "urban" *okrŭgs* of Sofia and Plovdiv contain a considerable area of agricultural land, especially the latter. Near the capital new irrigation schemes, using the impounded waters of the river Iskŭr, should lead to a greater output of local produce for the city, and the environs of Plovdiv, with both old and new irrigation schemes using the waters of the river Maritsa, are particularly noted for their quality fruit and vegetables for the national and international markets. While grain farming (chiefly wheat, barley and maize, except in upland areas, where some rye is grown) and animal husbandry (variously associated with hill pastures, feed grains and fodder crops, including maize silage) generally predominate in most farming districts, there are also very important specialized crop districts, such as the plum-growing belt on the northern flanks of the Stara Planina, falling in Lovech, Gabrovo and Tŭrnovo *okrŭgs*; the apple orchards of the upper Struma basin, in Kyustendil; the rose gardens of the "Rose Valley", in Plovdiv and Stara Zagora; the tobacco-growing areas of the Arda, Struma and lower Maritsa basins, in Kŭrdzhali, Blagoevgrad and Khaskovo; and the cotton fields of the Plain of Thrace, in Khaskovo, Sliven, Stara Zagora and Yambol.

Apart from their economic functions, embracing agriculture, industry, trade and economic planning (in the light of the national plan), the authorities ("People's Councils") in each of the new *okrŭgs* will also exercise considerable administrative and political functions; the country will be transformed, it seems, into a group of associated socialist communities. Incidentally, although Bulgaria has been likened to China in that they are both feverishly engaged in a "great leap forward" economically, the administrative changes in Bulgaria should not be confused with the more radical "commune" system now being introduced in China. What is undoubtedly important is that, in the interests of the economy as a whole, the new Bulgarian system should preserve, and not undermine, the traditional qualities of diligence and thrift, which have always attracted the notice of outsiders. It is, therefore, reassuring to note that the changes have been accompanied by a new stress on managerial efficiency and workers' incentives.

University of Nottingham R. H. Osborne

RECENT CHANGES IN THE ECONOMIC GEOGRAPHY OF MALAYA

The post-war period has seen marked changes in the political and economic status of most Asian countries. In Malaya, independence for the Federation of Malaya in 1957 was followed by the establishment of internal self-government in Singapore in 1959. Both the Federation and Singapore

were already relatively maturely Westernized and well developed in comparison with most other Asian countries. Rapid post-war economic progress has raised the socio-economic levels of the people and both countries face the problem of rapidly growing populations and the urgent need to expand their economies.

Population increases in the Federation and Singapore have been more dramatic than in most countries of the world. In the Federation the population rose 27·5 per cent between 1947 and 1957, to a total of 6,278,763. In Singapore the population almost doubled in the same period, to reach 1,445,930 in mid-1957. The areas of the two states approximate to 50,000 and 224 square miles respectively.

In the Federation the greatest population increases have been in the western half of the country, which accords well with the established patterns of land use and raises an interesting long-term consideration of potential population increase and density in the predominantly Malay east coast states. So far the areas of greatest post-war increase have been the much more developed states of the west. The east remains comparatively empty, its inhabitants largely concentrated on the alluvial plains of the lower Kelantan and Trengganu rivers.

Population increase 1947–1957

	State	*Absolute*	*Percentage of* 1947 *total*
Western	Perlis	20,376	28·9
	Kedah	147,202	27·6
	Penang	125,811	28·2
	Perak	267,452	28·0
	Selangor	302,103	42·5
	Negri Sembilan	96,663	36·1
	Malacca	51,890	21·7
	Johore	189,314	25·6
Eastern	Pahang	62,771	25·1
	Trengganu	53,169	23·5
	Kelantan	57,013	12·7

The post-war population increase may be localized even further by a consideration of the changes in the urban geography. Singapore, the largest urban centre in Malaya, now ranks as one of the "million" cities of Asia. In 1947 there were only 22 towns in the Federation exceeding 10,000, accounting for 6·9 per cent of the total Federation population. In 1957 there were 37 such towns, accounting for 26·6 per cent of the population. The capital, Kuala Lumpur (316,230), has almost doubled its population in ten years, its nearest rivals being Penang (234,930) and Ipoh (125,776).

The expanding population has been supported primarily by the buoyant rubber industry of the Federation. This itself has been favoured by the high prices induced by the Korean War and by the disorganized economic

Federation of Malaya and Singapore

	Rubber Production	*Concentrated Latex*
	tons	tons
1930	452,000	—
1940	547,200	—
1947	646,400	32,159
1950	694,100	73,616
1954	586,500	95,510
1957	637,500	107,996

condition of Indonesia, its main competitor. The bulk export of rubber in the form of liquid latex has assumed major importance in recent years.

Although rubber plantations suffered damage and neglect through World War II and the Malayan Emergency, they have now largely been restored and the Federation has an extensive replanting programme under way. The use of early maturing and high yielding varieties of rubber in new and replanted areas is ensuring an intensified rubber production in the future and should make the Federation undisputed leader in world natural rubber production in a few years.

In the Federation's other agricultural activities, the cultivation of rice has shown a steady post-war increase in acreage and production. New irrigation schemes in coastal North Selangor and the use of fertilizer and improved varieties of rice have meant that about 60 per cent of the country's needs have been met by home production in recent years. The production of oil palm and pineapples (mainly located in Johore and Selangor) has also increased but that of copra has not. The experimental trials of cacao in Trengganu have as yet been rather disappointing, and there appears to be no immediate likelihood that cacao will become a major export crop.

The tin industry has passed through a difficult period in the last decade. The price of tin on the world market has fluctuated widely so that a scheme for stabilization of the market has again been tried. From 1956 the International Tin Agreement had aimed at maintaining prices at a reasonable level for both producers and consumers, and in establishing a long-term equilibrium between supply and demand. Tin production in Malaya for the last five years has remained at about the 60,000-ton mark and it is unlikely to increase greatly without a major change in demand. A brighter mineral prospect for the Federation is iron ore. A mine at Bukit Besi, inland from Dungun in Trengganu, is producing more than 2 million tons per year. A deposit of comparable size in southern Pahang is expected to be developed within the next few years. Japan is a willing buyer of the ore. Bauxite from the southeastern tip of Johore is currently being exported to Japan, Taiwan and Australia at the rate of about 250,000 tons per year. Coal-mining at the one useful deposit, Batu Arang in Selangor, has virtually ceased, though gold continues to be mined at Raub, and ilmenite, a by-product of tin-mining, has been a profitable export until recently.

Secondary industry continues to expand. In 1957 there were over 4000 factories employing power-driven machinery in the Federation, and classes of industry included handicrafts (e.g. rattan ware, *atap* (palm-leaf) thatch, weaving, gold-smithing), processing (e.g. rubber milling and packing, tin smelting, wood-, rice-, coconut- and palm oil-milling, fish curing), food, drink and tobacco, engineering (e.g. railway workshops, dockyards, motor vehicle workshops, electrical installation and repair work, foundries) and other manufacturing (e.g. bricks, tiles, cement, soap, metal containers, rubber goods (especially footwear), furniture).

Industrial activity is largely localized in the main towns, drawing employment from the increased urban populations. Kuala Lumpur and its satellite town, Petaling Jaya, form a recognizable industrial centre, conveniently situated some 25 miles inland from Port Swettenham. Penang and Butterworth, its mainland counterpart, comprise a second industrial area, with Johore Bahru, with its easy access to Singapore, as a third. Ipoh and

adjacent towns in the Kinta valley form the fourth main area of industrial activity in the Federation.

Singapore Island has seen an increase in its industrial establishments, which are largely of a marine servicing nature, although facilities for the entrepôt processing of goods continue to be important. Singapore, always primarily a trading port, has about one-third of its trade with the Federation, one-third with the traditional entrepôt countries—Brunei, North Borneo, Sarawak, Indo-China, Indonesia and Thailand.

The prospects for Singapore are not unclouded. The Federation is endeavouring to become as economically independent of the island as possible. The post-war growth of Port Swettenham's trade, the establishment of Malayan head offices of commercial businesses in Kuala Lumpur, and the growth of that town are indicative of the degree to which this aim is being achieved. Uncertain political and economic conditions in Indonesia have been reflected in Singapore's trade with that country. Doubts as to the island's internal political stability have led to some uncertainty in investment there. On the other hand, potentials for development in neighbouring land areas are high and it is possible that Singapore may even increase its relative world importance as a trading centre. Economic prospects for the Federation are good. There is a likelihood of a strong future market in natural rubber and land is available for the development of this small country. In its present stable political state and relatively advanced economic condition, the Federation of Malaya is an example to other Asia countries in its planning for future economic and social development.

University of Auckland MARION W. WARD

REDUCING WATER LOSS IN SOUTH AUSTRALIA

Water conservation in South Australia, particularly in the high-evaporation, arid areas of the state is a major problem for graziers, farmers and metropolitan water authorities alike. Total annual amounts of precipitation are small. Less than 5 per cent of South Australia has over 20 inches a year, less than 10 per cent has more than 15 inches, but well over two-thirds of the state has under 8 inches of rainfall annually. Rainfall is also extremely variable, both in volume and incidence. Annual precipitation for Adelaide (annual average rainfall 21 inches), in the moistier southern part of the state where rainfall is more reliable than much of the state, has varied from 13 to 27 inches during the last five years. In the first six months of 1960 precipitation exceeded the year's total for 1959. Rainfall is often of high intensity and short duration so that much is lost through excessive runoff. Of even greater importance is the fact that evaporation is high, and this is responsible for heavy losses of water from reservoirs, and from farmers' and graziers' open storage tanks. Except for the southern half of Eyre Peninsula all of South Australia, north of 35° S., has an annual average evaporation greater than 50 inches. In the northern half of the state annual average evaporation is from 90 to 110 inches annually.

For farmers and graziers, two main methods for water conservation are possible, first, by storing excess runoff in reservoirs; and secondly, by

reducing evaporation from them. Water storage demands careful consideration of the form of the reservoir. An inch of runoff from 45 acres yields one million gallons of water, but the opportunity to fill a reservoir more than once a year occurs rarely in South Australia. However, in areas with 12 to 14 inches of rainfall 25 acres of *graded catchment* will give one million gallons of runoff even in a drought year. Evaporation from a shallow storage reservoir in a dry year is often over 50 per cent but will be only 20 per cent from a deep storage reservoir. However, the answer is not necessarily to be found in deep reservoirs. In many cases the same amount of excavation on a flat site will give five times greater storage capacity than on a deep site. In practice it has been found that a storage ratio* less than 6 : 1 is uneconomical. In special circumstances a lower ratio may be economical, as for example, for a livestock water tank where large numbers of sheep may be grazed where none were grazed before. Reservoirs with a low storage ratio are also economical for fire-fighting purposes where they may prevent thousands of pounds worth of damage.

After water storage dams have been built, there are problems of loss through seepage and loss through evaporation. Methods used to counteract seepage over the whole area of the reservoir vary, but in most cases all are costly. These methods include the following:—

Plastic liners. Thin impervious membranes (from 0·004 inch to 0·01 inch thick and costing from 4s. to 6s. per square yard) are laid over the bed of the dam and lightly covered with a 12-inch layer of soil to safeguard against puncture by livestock and burrowing by small freshwater crustaceans.

Chemical sealing by the use of sodium tripolyphosphate. This is effective only if soils have a 5 per cent or greater clay content. If calcium is present, the effect of the chemical is eventually neutralized and another chemical treatment is required.

Bentonite, an imported clay from U.S.A. costing £A35 per ton, which has a very high expanding capacity. This clay enters the soil pores, expands, and thus seals them. The average dressing required, however, is 1 lb. per square foot or 20 tons per acre.

The use of *soil cement*, still in the experimental stages, may be economic. Using a mixture of 10 per cent cement and 90 per cent soil it is hoped to seal a thin layer. This requires 16 tons of cement per acre-inch, with cement costing £A10 per ton.

To counteract evaporation on small dams the Commonwealth Scientific and Industrial Research Organization five years ago developed the use of hexadecanol (cetyl alcohol). This involves the use of little anchored rafts which release this insoluble chemical, causing it to float as a white waxy substance on the surface of the water and thus restricting evaporation by covering the surface with a thin film. This reduced losses by a quarter or more but was unsuited for areas greater than two acres in extent because ruffling of the surface by wind disrupted the film. It has been found that the height of wavelets is directly proportional to the size of reservoirs.†

* Storage ratio $= \frac{\text{Volume of water} + \text{Volume of bank}}{\text{Volume of bank}} : 1$

† $h = 0{\cdot}025\sqrt{L}$, where h = height of wavelets in feet, and L = greatest length of water surface.

In July 1960 the C.S.I.R.O. successfully demonstrated a method of cutting, by half, the huge evaporation of valuable water from large storage reservoirs such as those which supply major cities with water. This method costs only one penny to save one thousand gallons. The evaporation loss at Adelaide's Thorndon Park Reservoir, a typical example, is 5 feet a year. This represents an annual loss of water sufficient to fill a medium-sized reservoir. In a dry season this additional water would be very useful, and the tremendous costs of pumping water from the river Murray to Adelaide would be substantially reduced. Hexadecanol is still used, at the rate of half an ounce per acre of water surface. The chemical is blown as a fine powder through a tube from the stern of a moving boat. The boat makes several traverses across the reservoir and the powder floats on the water to form a thin film which reduces evaporation. This method is quick, economical and efficient as a few hundred acres can be fully treated in half an hour. A daily trip is required to replace lost hexadecanol, but once the film is established a single trail laid round the storage reservoir is sufficient to spread out and cover it completely.

The University of Melbourne G. Ross Cochrane

A One-Day Conference on the Teaching of Geography

A REPORT

On 28th may 1960, some 200 geography teachers attended a one-day conference at Manchester University, organized jointly by the School of Education and the Manchester Branch of the Geographical Association.

The opening lecture was given by Mr. E. C. Marchant, H.M.I., who spoke on *Geography and Education*. Mr. Marchant suggested that the impact of geography on the education of the pupil might be looked at at three levels.

The level of purely factual information. It is normally assumed that geography should acquaint children with where places are, and there is often complaint nowadays that, with new fashions in education, this is not in fact happening. This, however, is not the result of new methods of teaching; it is simply the result of carelessness and imprecision in the use of these newer methods. It is not a reason for returning to "capes and bays". In addition to a knowledge of locations, one might require of geography that it should give to all pupils accurate factual knowledge of the background to some of the problems of world affairs. One cannot perhaps directly teach international-mindedness but one can give the facts on which wise judgments can be based. Mr. Marchant illustrated this point from the geography of Africa and Asia, both of which are so important at the present time, and there was a plea that these two continents should not be avoided in the syllabus on the grounds that it is easier "to get pupils through the examinations on Australia".

The level of intellectual training. The grammar school tradition eschews useful knowledge and bases its reputation on the rigour of its intellectual training. This was particularly true of the old classics tradition. The world at large is not fully persuaded that a training in geography is, or even can be, as exacting as one in many other disciplines. The alternative "Latin or Geography" makes this point. Geographers are aware of the criticism and anxious to meet it. The late Mr. C. C. Carter, remembering his own training in the classics, wrote a *Geographical Grammar* which had to be learnt as a preliminary to a course in geography, by which means he hoped to impose a rigorous training equivalent to the one he himself had enjoyed. Mr. Marchant believed that there *is* a "grammar" of geography and that it is salutary to the discipline of the subject that that grammar be at some time acquired. However, modern language teaching largely derives the grammar from the language, not the language from the grammar; and scientific method requires that generalizations be built up empirically, not learnt at the outset. Working from the particular to the general is desirable also in order to enlist the active interest of the child. In geography, field work and its methods—observation, recording, interpretation of pictures and statistics—are important illustrations of this.

Written work at sixth-form level should always be concerned with ability to argue with logic, evidence and economy and not merely with ability to remember facts.

The level of geography as a humanity. Most of us believe that geography is something more than useful information and intellectual training. We generally claim that geography, as well as being a science, is also an art. In what respects is it an art? In describing a region there is something more than the sum total of its parts. One often feels this when studying a small region in the field. This can be brought out by subjective selection.

If in addition to selection the geographer can use the overtones of words to evoke the spirit of a region then he is truly being both a scientist and a humanist. Roxby, Fleure, Mill and Vidal de la Blache have used the evocative power of words. A passage from a French description of Provence* was quoted, but it was admitted that such descriptions are rare—for they imply a very rare combination of the gifts of scientist and humanist. Nevertheless it is perhaps worthwhile sometimes giving children glimpses of such a possibility.

After the introductory lecture members of the conference had the choice of attending a Symposium on "Sixth-Form Work in Geography" led by Mr. A. C. Woods, Headmaster of Alleyne's Grammar School, Stone, and Miss R. M. Gleave, Deputy Headmistress of Withington High School for Girls, Manchester; a lecture by Mr. L. H. Hadlow of Burnage Grammar School, Manchester, on "The World Approach in the Grammar School Geography Syllabus"; or an address by Dr. D. W. Shave, Vice-Principal of Bishop Otter College, Chichester, on "Geography and Realities", with special reference to secondary modern schools. Summaries of these addresses follow.

Sixth-form work in geography. Sixth-form geography provides a discipline in its own right and also has great merit for the non-specialist. It may be an integral part of a general studies course which includes economics, Greek tragedy, political history and art appreciation. For the sixth-form specialist the subject becomes more exciting and pupils perhaps begin to realize the enormous enjoyment that comes from study. Teaching becomes more exacting. The geographical essay is most important but should not be too long; let the students spread themselves occasionally but let them also be set to do questions against the clock.

The aims of the course should be precisely determined and kept in mind. They will include a correct geographical vocabulary, a critical sense (textbooks are sometimes wrong and frequently out of date), a thorough understanding of maps, upon which the whole course should be centred, and some basic ideas on physical geography. At least one major part of the world should be studied in detail while the close study of a small area is desirable. To link all this, particular attention should be paid to an understanding of one's own country and especially of the local environment based upon practical work and at least one field survey.

The world approach in grammar school geography syllabus. Mr. Hadlow considered whether the "world approach" is to be preferred to the regional

* V. Armand Lunel, "Géographie de la Provence", *Revue des Deux Mondes*, December 1st, 1956.

method in work below the sixth form. Using the former method all the more important topics relating to man and his environment can be arranged logically to suit the age-groups of the pupils. Most teachers would agree that the first year should be reserved for the geography of the home region and country but after this world studies can with profit be pursued throughout the second, third and even fourth years, leaving to a late stage the summing-up on regional lines of the more important parts of the continents. For instance, the lithosphere can supply the theme for a second-year course in which, after an introduction concerned with rocks and their classification and uses, the structural elements of the continents can be studied, followed by the major landforms. Similarly, movements of the earth, the atmosphere and the hydrosphere can form a basis for third-year work, incorporating the results of rotation upon the axis and revolution round the sun, ocean currents, the factors controlling the elements of climate and weather, and the study of the world's climatic regions. The fourth year can be occupied with economic geography, bringing in its wake a host of topics relating to man's work and needs. By this time, too, the pupils are in a position to undertake some regional geography. This can start with the British Isles, and the regional geography of selected portions of the continents can be continued throughout the fifth year, being assisted in no small measure by the world studies of previous years. It should be stressed that throughout any world approach syllabus every possible opportunity should be seized to cull from different regions examples illustrating how the particular topic under consideration affects the life and activities of man, so that at all stages the world geography course is in essence a synthesis of physical, economic and human geography.

Geography and realities. In the secondary modern school, vivid oral description and first-hand experience will bring reality into the pupils' concepts, while there should be more realism in the choice of subject matter. There could be closer relationship between the work in school and the everyday work of the world which the pupil is looking forward to entering. Again, there is a need to put more emphasis on the global aspects of the subject—the geography behind world problems such as the distribution and rate of increase of world populations, food supply, the distribution of raw materials and power resources. There could be greater use made of the discussion method, more posing of problems and more frequent reference to sources of information. "Mankind must be made much more aware of the world it lives in, its rigorous limitations and its limited possibilities. Above all it must be assisted and persuaded to think of the world as a whole" (D. L. Linton).

In the afternoon the conference sub-divided into groups to discuss the lectures of the morning session and to formulate questions put to a "Brains Trust" under the chairmanship of Dr. Gwyn Thomas, Director of Education for Stockport. The discussion covered topics which included the following:

Q. Should the secondary Modern schools have external examinations?

A. Yes, as a stimulus, to which they respond well, but a secondary modern school should study the body of knowledge pertinent to that school rather than seek to imitate the grammar school.

Q. Can the Brains Trust suggest a geography syllabus for the fourth year of a secondary modern school bearing in mind that children leave at three stages?

A. Take geography in units likely to interest the pupils—they are not interested in the syllabus as such nor do they look for unity in the overall plan.

Q. What is the minimum content one should expect a pupil of 15 years to have covered in geography before leaving the secondary modern school?

A. Syllabus is a personal matter; concentrate on the geography behind current problems; do something in such detail that it comes to life. It does not matter whether you are dealing with A, B, C, or D streams—put your "intensive bits" on the map.

Q. Does the Brains Trust believe that the "world approach" can be adapted to all streams?

A. Yes, if you drop the more difficult terms and topics. Even isostasy can be adapted to less able pupils. One possible danger of the concentric method may be mentioned—that of thinking of oneself as the centre, instead of giving thought to people all over the world living their *own* lives.

Q. Should elementary meteorology and map projections be included in sixth-form work?

A. Yes.

Q. Can the Brains Trust recommend six books for sixth-form geographers to read?

A. Suggestions included books by Grimble, Somerset Maugham, Mackinder, Defoe, Cobbett, Wooldridge (*Spirit and Purpose of Geography*), Slocum (*Sailing Alone Round the World*)—and a good atlas, for half an hour a day.

Q. What improvements in Advanced level geography papers can the Brains Trust suggest?

A. Separate papers for O.S. map work; more emphasis on distribution maps, elementary surveying and field work; more questions on large areas, e.g. U.S.S.R. Less invitation to regurgitate facts. Let the questions be direct and require some argument; let there be real thinking and real judgment in the light of that thinking.

W. H. Shepherd

The Geographical Association

SUMMER SCHOOL 1960

A very successful course for the demonstration of field techniques was held at the new centre of the Field Studies Council at Slapton Ley, South Devon, under the leadership of Mr. R. A. G. Savigear and Mr. B. Coates of the University of Sheffield, and Mr. R. S. Waters of the University of Exeter. We are deeply indebted to these leaders and to their assistants for their help in this important work, and to the Warden of the centre, Mr. I. D. Mercer.

FOREIGN SCHOOLS IN 1961

An Easter School will be held in southern Italy from 1st to 15th April under the leadership of Mr. A. F. Martin and Dr. J. M. Houston, both of the School of Geography, University of Oxford. Any members still interested in joining this school who have not yet made application should do so immediately.

Plans for the second Summer School to be held in West Germany under the leadership of Mr. T. H. Elkins and Dr. E. M. Yates, both of King's College, University of London, are now well advanced. The course will be centred at Kettwig in the Ruhr valley and Tübingen in Württemberg and will take place from 27th August to 2nd September. Registration for this course should be made without delay as numbers will be limited.

SPRING CONFERENCE 1961

The Spring Conference 1961 will be held from 4th to 8th April at Bristol by the kind invitation of Professor R. F. Peel, the University of Bristol and the local branch of the Association. Accommodation will be in University Halls of Residence. Programmes and registration forms will be issued to all members in January 1961.

Hugh Robert Mill: An Autobiography

We are grateful to Professor L. D. Stamp and the publishers for making arrangements whereby the small remaining stocks of the autobiography of the late Dr. H. R. Mill, one of the founders of the Geographical Association, are being offered free to libraries and individuals who may be interested. One shilling and sixpence to cover postage (sent in stamps for addresses in the United Kingdom) should be sent to Messrs. Longmans, Green & Company, The Pinnacles, Harlow, Essex.

BRITISH ASSOCIATION 1961

The 1961 meeting of the British Association will be held from 30th August to 6th September in Norwich. Professor S. H. Beaver is the President-Elect of Section E (Geography). Professor M. J. Wise and Dr. J. W. Birch have retired from office as Recorder and Secretary respectively, being no longer eligible for re-election. Mr. N. Stephens of the Queen's University, Belfast, who has previously served as Secretary becomes the new Recorder, and Dr. S. R. Eyre (University of Leeds) and Mr. H. A. Moisley (University of Glasgow) become the new Secretaries. Offers of papers to be read at the Norwich meeting and other correspondence regarding the Section should be addressed to Mr. N. Stephens at the Department of Geography, Queen's University, Belfast.

TRAVEL BURSARIES TO AUSTRALASIA AND CANADA

Last year the Trustees of the Imperial Relations Trust generously announced their intention to award two travel bursaries, each tenable for six months, to enable two members of this Association to travel in Australasia and Canada respectively. About

seventy applications were received and the selection of only two nominees out of so many candidates presented much difficulty to the selection committee.

The first nomination for Australasia was that of Mr. W. R. A. Ellis: he has, however, been unable to accept the Bursary because school staffing difficulties prevented leave of absence being granted for the appropriate time. We are glad to report that, from the list of reserve nominees, the Trustees have been able to make this award available to Mr. E. M. Driscoll of the Department of Geography, University of Liverpool.

The nomination for Canada put forward by the selection committee and accepted by the Trustees was that of Miss Mary Denham, a graduate of the Oxford School of Geography with considerable and varied school teaching experience.

To both our Bursars we wish pleasant and rewarding journeys and we look forward to hearing accounts of their travels on their return.

SPECIAL PUBLICATIONS

British Landscapes through Maps

The first two books in this series, which is edited by Professor K. C. Edwards, are *The English Lake District* by F. J. Monkhouse and *The Yorkshire Dales* by C. A. M. King. Both are illustrated with photographs and maps. Orders should be sent direct to the Association, the price to members being 3s. 6d. each post free, or 3s. 3d. each for orders of 12 or more at one time. Books of exercises on the Ordnance Survey Lake District Tourist Map and the one-inch sheet 90, Wensleydale, have been prepared by the Secondary Schools Section of the Association in the same format as the *British Landscapes through Maps* series and for use with it. These booklets may be purchased from the Association by members for 1s. 6d. each post free, or in sets of 12 or more, for 1s. 3d. each post free; payment should be sent with the order.

Geography in Secondary Schools

A reprint of this booklet, newly revised to bring reference material up to date, is now available. The price remains at 2s. post free.

SECTION REPORTS

ASSISTANCE FOR FIELD WORK IN SECONDARY SCHOOLS

The Secondary Schools Section Committee would be glad to receive information from members regarding the assistance they have received from Local Education Authorities or other bodies in arranging field work for their pupils. Information is desired both concerning financial assistance and assistance of other kinds, e.g. provision of accommodation at suitable centres, and for work at any level in the secondary school. It would be helpful if distinction is made between assistance for field work and for school journeys, for staff and for pupils, for work abroad and for work in this country, for work at approved field centres and for courses arranged by and at centres selected by the teachers themselves, and, if it could be indicated, whether financial assistance has taken the form of block grants or payments of a percentage of the expenses.

MAPWORK AND THE USE OF MAPS IN SCHOOLS

A report of a discussion led by Mr. T. W. Brown* at a meeting of the Training College Section, 14th May 1960

Mr. Brown's talk "An investigation into the optimum age at which different types of map questions may best be set to pupils in the teaching of geography" was a

* Mr. T. W. Brown, Headmaster of the Kings School, Gloucester, is British representative on the Commission on the Teaching of Geography of the International Geographical Union.

summary of the report on the work of a sub-committee* appointed to investigate the particular problem of children's ability to read maps. He began by summarizing some earlier findings on the subject which have been published in the Association's journal:

(*a*) Miss Ethel David: "Children's maps: an experiment", *Geogr.* vol. xxv, 1940, pp. 86–9.

(*b*) A Report by the Training College Group Committee: "An investigation into children's ability to interpret contour lines", *Geogr.* vol. xxvi, 1941, pp. 131–40.

(*c*) Miss Ethel David: "The teaching of contours", *Geogr.* vol. xxix, 1944, pp. 57–61.

(*d*) Mr. E. O. Giffard's independent conclusions which will be published in the January 1961 number of *Geography*.

Proceeding to the present investigation, Mr. Brown explained that following an exploratory pilot scheme in the Bristol area, questionnaires were sent in the summer term of 1959 to 1,000 pupils in selected Primary, Secondary Modern, Bilateral and Grammar Schools in the Nottingham, Gloucester and London areas. Headmasters and geography staffs had very kindly co-operated in organizing tests within their schools. In all cases the maps used in the tests were the 25 inch, 6 inch, $2\frac{1}{2}$ inch and 1 inch O.S. maps and two school atlases (Philip's *Pictorial Atlas* and Philip's *Modern School Atlas*). The pupils were divided into two groups: an A group with I.Q.s above 120 by the Stanford Binet scale, and a B group with I.Q.s of 100 to 105. Schools in the Gloucester and Nottingham areas had taken the shorter test in which the six questions on scale and the six composite questions for the $2\frac{1}{2}$ inch map used in the pilot scheme were used again. In the full test used in selected schools in the London area, composite questions on each of the maps were set.

An analysis of the results had given the following indications:

1. Conventional signs present little difficulty.
2. Direction is only slightly more difficult.
3. To visualize relief from contour lines is not such a difficult process for the young child as is sometimes supposed. Contours at 10 years old might be feasible.
4. The use of the grid reference system and the teaching of location of individual buildings and sites can well be accomplished at the time of the initial training in fractions.
5. Scale should not be taught before the age of 11.
6. The interpretation of physical features and discussions of settlement problems present the hardest tasks to the teacher and it is doubtful whether these should be attempted before the age of 14.
7. The value of the O.S. maps over the atlases was apparent and the *Pictorial Atlas* was considered better than the *Modern School Atlas*. The need for an atlas to be suited to a particular age and degree of development was apparent. Many pupils expressed a preference for the $2\frac{1}{2}$ inch map; it was the best liked and understood but whether because it was most used in the test is uncertain.
8. Age 11 shows up as an age of accuracy; after 11 there was often a falling off which was not made up until the age of 14. Why should this be?
9. Boys are better than girls over the age of 12. The gap closes again at 15. What happens at 16?
10. Simple map reading as distinct from map interpretation can be accomplished by less bright children from the age of 12.

The discussion that followed centred particularly on certain points.

* The sub-committee: Mr. T. W. Brown, Miss R. Bowyer, Professor K. C. Edwards, Mr. E. O. Giffard, Mr. R. C. Honeybone.

(*a*) The falling off in efficiency indicated in the 12+ results.

Among contributing factors suggested were pressure on pupils before entering the Secondary School, the after effects of the change of school, and the introduction of a number of new subjects in the curriculum. But a falling off in efficiency and a falling off of interest at 12+ could be noted in other ways and might be due to some inherent psychological trait in the make-up of the child. It was referred to by the Committee as an "adolescent dip". The falling off was not so marked in the B group. Mr. Brown pointed out that memory had not been tested at all. In reply to another question Mr. Brown said that no attempt had been made to distinguish between trends in the Grammar and Secondary Modern Schools, but that among the 1,000 pupils tested two thirds had been pupils of Grammar and Bilateral Schools.

(*b*) The relative ability of boys and girls.

Attention was drawn to the apparent superiority of girls over boys up to the age of 12, then of boys over girls from 12 to 14, while at 15 the difference is slight. What would tests at 16+ show? Mr. Brown suggested this would be a fruitful field for further investigation. The relative standing of geography in sixth forms in boys' and girls' Grammar Schools was referred to and it was thought that perhaps more bright girls take geography in the sixth form than boys, because the brighter boys tend to take pure science.

(*c*) The interpretation of physical features and settlement.

It was agreed that such questions were not well done till the age of 13. Both require a previous training in other aspects of map reading and may involve additional background knowledge, as well as the ability to reason from evidence obtained from the map. These capacities seldom come within the experience of the younger children.

(*d*) The relative accomplishment of the A and B groups at simple map reading.

On this topic various points were raised. Is simple map reading as easy for the less able? Is geography a subject in which the less able can shine? How far does ability in map reading indicate an ability in geography as a whole? It was pointed out that ability in geography indicates a general ability and may bear little relationship to a high I.Q. Some pupils with a high I.Q. are not good at Geography.

Comments on the investigation:

Mr. Honeybone explained that there were many gaps in this investigation which would be followed by more detailed research in which more would be known about the children questioned. Mr. Brown said that the Committee had no knowledge whether the children were familiar with Ordnance maps of the scales used. The time given to the test had varied, but in no case was it longer than one hour. In the pilot scheme some answers were given orally, but in the main scheme all were written; the results, however, seemed accordant. Further research would show whether pupils unable to express themselves clearly and quickly were at a disadvantage in map work. The atlases used were in some cases unsuitable for the younger children, but were the only ones which could be supplied immediately. In spite of all these limitations the results appear significant: they accord with the experience of many teachers and with many of the findings of earlier investigations.

CAREERS FOR GEOGRAPHERS

At a recent meeting of the Public and Preparatory Schools Section in Cambridge the difficulties of attracting the most able boys and girls in the sixth form to do geography were discussed. One of these difficulties is clearly the mistaken impression among pupils, parents and headmasters that a training in geography leads only to the teaching profession. Accordingly Mr. A. A. L. Caesar and Mr. B. H. Farmer have gathered together some figures which throw light on what actually happens to graduates in geography. They specify the careers taken up by a total of 162 members of St. Catherine's and St. John's Colleges, Cambridge, who graduated through the

Geographical Tripos in the years 1949–59. They have also supplied some notes on the figures, and express the hope that teachers will find them useful.

Group 1.	*Those who are using their geography professionally:*	
	Research and other post-graduate work	11
	University lecturing (including extramural work)	16
	Training College lecturing	2
	Surveying	10
	Soil and/or land-use surveying	2
	Planning	2
	Posts as map curators and research officers	3
	Physiographical laboratory	1
	Geographical publishing	2
		49
Group 2.	*Those who are teaching:*	
	Public schools	9
	Grammar schools	28
	Army or Navy educational services	4
	Secondary Modern schools	4
	Overseas schools	2
	Precise category of school unknown	5
	Diploma in education	3
		55
Group 3.	*Those who used their geography as a liberal education:*	
	Church	4
	Civil Service and Overseas Service	3
	Business, industry and commerce	45
	Social welfare	1
	Transport	2
	University administration	1
	United Nations	1
	B.B.C.	1
		58
	TOTAL	162

Notes on the figures:

(i) The figures apply to men whose careers could be traced at 1st October 1959.

(ii) Figures from a representative sample from women's colleges might tell a rather different story.

(iii) Since both Colleges make entrance awards in geography the figures apply to a sample of rather more than average calibre; but, after all, it is boys like this that one hopes to attract, and the figures show what careers are open to such boys.

(iv) Experience shows that in many years there are not enough geographers of high calibre to fill all the vacancies that occur in Group 1 of the table.

(v) The total number in each of the three Groups is approximately equal. This is contrary to the widely held notion that all the geographers can do is to teach geography in schools.

A revision of the memorandum "Careers for Geographers" is published in the *Geographical Journal*, vol. cxxvi, December 1960.

Reviews of Books

With very rare exceptions books reviewed in this journal may be borrowed from the Library by full members and student library members of the Association.

Scottish Field Studies Association. I. Annual Report 1959; II. The Geography of the Garth Area, The Central Highlands in Miniature. J. Tivy. 17·5×23 cm. 28 pp.+3 plates. Glasgow: Scottish Field Studies Association, c/o Department of Botany, The University, Glasgow, W.2. 2s. 6d.

Scotland is less fortunate than England in the provision of field studies centres for those sciences in which outdoor work is an essential part. The Field Studies Council maintains centres only in England and Wales. The Scottish Field Studies Association has, since 1944, attempted to redress the lack of facilities and since 1951 has operated a field centre at Garth Memorial Youth Hostel near Glen Lyon in Perthshire; courses have also been organized at other residential centres. The Annual Report for 1959 tells of the growing support for these activities, especially at Garth where, according to Mr. A. Riddle, Field Studies Assistant there in the summer of 1959, facilities for the study of geomorphology and rural settlement and economy are excellent. For teachers seeking new ground for geographical field work—especially if their parties can go there in May or September—Garth offers a terrain very different from the surroundings of the centres in England.

Part II of the Report is a 14-page study by Dr. Joy Tivy of the Garth area which she describes as "a microcosm of the Central Highlands of Scotland". This account, naturally useful to anyone visiting the Grampians, could also provide the teacher in the classroom with a "close-up" of this region: the text has the familiarity that comes of working on the ground of the area; the vocabulary and the place names are real and evocative. This is not surprising when one reads that the article and the maps are based on detailed material collected and compiled by members of geographical field classes working at Garth. Besides geological, land-use, and settlement maps, the text is illustrated by three air photographs, including a fine view of the road to the Isles, looking up loch Tummel and loch Rannoch.

M. O.

The Third Statistical Account of Scotland. Vol. V. The City of Glasgow. J. Cunnison and J. B. S. Gilfillan. 15×23 cm. 1008 pp. Glasgow: Collins. 1958. 50s.

The *Third Statistical Account* will take the form of about thirty self-contained volumes each giving a comprehensive mid-twentieth century account of economic and social conditions in the counties and cities of Scotland. The "Old" and "New" Statistical Accounts, describing conditions in the 1790's and 1830's respectively, were the forerunners of the present "Third" Account, which is sponsored by the Scottish Council for Social Service.

This fifth volume deals with the city of Glasgow, and its constituent chapters have been written by Glasgow University specialists in the main. The volume should be of considerable use to the geographical public—the dust-jacket speaks only of the general reader and the historian, economist and sociologist—and while local geographers have not participated directly it is gratifying to note the assistance they have rendered in various ways. It is, incidentally, a pity that they did not spot the statement (p. 28) that Glasgow is the most northerly city in the world with a population of over one million!

Although the aim is to give a detailed picture of present conditions, there is, in fact, considerable historical detail, showing how Glasgow developed from a small

medieval cathedral and university town into a major industrial and commercial city forming the heart of one of our great conurbations containing more than one-third of the total population of Scotland. It is, perhaps, a drawback that the city is treated in isolation from the rest of the conurbation; in particular the whole question of industrial and residential decentralization, which is Glasgow's greatest current problem, should surely have merited special attention. It must be admitted, however, that some of the contributors do reach out quite justifiably beyond the boundaries of the city in dealing with their allotted topics, e.g. in the sections on the industrial pattern and the iron and steel industry. No doubt this artificial separation of Glasgow from the rest of the conurbation is the inevitable result of a policy which views Scotland as a mosaic of watertight cities and counties, but it is to be hoped that in other parts of the country (e.g. the Tweed Basin) we shall have one regional volume rather than a succession of small county volumes.

Parts One and Two ("The Background" and "The City's Economy") will be of most use to geographers, the former providing a very readable account of the city's growth and the latter providing a detailed survey of the leading industries. Here the information about individual firms, derived from a special survey, will be of value. Parts Three and Four ("Public Administration" and "Community Life") will be of less interest to geographers, although the latter provides interesting reading for those who are fascinated by the "personality" of Glasgow, marred as it is, despite much recent improvement, by such features as notorious overcrowding, a high incidence of tuberculosis, and the "undercurrent of veiled animosity" between Catholics and Protestants.

R. H. O.

Agriculture and Urban Growth: a study of the competition for rural land. G. P. Wibberley. 14·5×22 cm. 240 pp. London: Michael Joseph Ltd. 1959. 21s.

Dr. Wibberley and his team of workers at Wye College have in recent years done much to advance knowledge of and develop techniques of analysis in rural land-use planning. In this book he applies his methods of rational measurement to many controversial issues of policy. Among the most valuable chapters are those appraising the returns, in money values, of programmes for land reclamation and improvement. The food formerly produced by land used for urban developments may be replaced by means of various improvement schemes and the author attempts to measure the likely variations in capital costs. He demonstrates the relatively high costs of improving hill farms; in addition, much social investment is necessary as, for example, in roads. By contrast the reclamation of woodland or dry gravel workings in the lowlands is shown to be very worthwhile, provided they can be taken into an existing farm without additions to its fixed equipment.

The value of Dr. Wibberley's approach is that he examines possible savings in all factors of farm production, not just in land. Yet the argument remains within narrow limits which he justly recognizes. When, for example, he discusses the choice between two sites for urban development their relative agricultural worth is assessed (using farm budgets) and contrasted with the "once for all" costs of site development. This certainly narrows the field of subjective judgement. The difficulty is that other questions, especially the recurring costs of bad industrial and urban location, are of towering importance.

This is a skilful and fair-minded contribution to current debates on public policy. All geographers will echo the author's plea for better land-use records and more analysis of schemes of land development.

J. E. M.

Atlas of the Arab World and the Middle East. 25·5×35 cm. 60 pp.+ index. London: Macmillan & Co. Ltd. 1960. 35s.

This atlas, which includes a wonderfully succinct historical introduction, presents maps of topography, historical geography, climatology, ethnology, and economy, which in most cases must have involved much original compilation, and whose intentions are generally excellent. Unfortunately, while the draughtsmanship and printing are of high quality, the information mapped is too often inaccurate, out-of-date, or discrepant. On page 9, for example, the Turkish oilfield is placed on the wrong side of the Tigris, and the gold workings of Mahd Dhahab should be shown as abandoned.

There is no indication on pages 22 and 24 that the southern pipeline from Iraq is no longer in operation, and the important Roseires and Dez water schemes are missing from pages 20 and 37 respectively. On page 39 the branch railway to Mardin is not shown, and on page 40 it is erroneous to draw citrus groves along the coast of Cilicia Tracheia, or cotton fields so high up the Ceyhan. The idea of showing types of settlement, on page 13, is good, but the lessons are obscure, and it might have been better to show one settlement at increasing scales. The map on page 7 shows languages rather than peoples, and omits the outlier of Aramaic speech at Midyat in Turkey. The population map on page 6 fails to bring out the high densities in the northern part of the Anatolian plateau. A comparison of pages 5 and 40 will show the Upper Euphrates basin as carrying forest in the one case and steppe in the other; neither version is accurate. In general, this atlas could serve as a useful reference for an area which is poorly documented, provided it is constantly checked and interpreted with the aid of up-to-date sources.

W. C. B.

Cahiers de Géographie de Québec, 3rd year, No. 6, April–Sept., 1959. Special number: **Mélanges géographiques canadiens offerts à Raoul Blanchard.** 17·5×25·5 cm. 494 pp. Quebec: Les Presses Universitaires Laval.

Raoul Blanchard was born in Orleans in 1877 and after a distinguished student career in Paris produced, while teaching in Douai and Lille, a brilliant doctoral thesis on the Flemish Plain after the model of Vidal de la Blache (published 1906). On the strength of this, he was appointed to a post in the University of Grenoble and for the succeeding 44 years, till he retired in 1948, he remained faithful to that University despite tempting offers from a dozen others, including the Sorbonne and Harvard. Grenoble determined the first interest of his career—alpine geography. Invited first to the United States in 1917, in the succeeding 20 years he was Visiting Professor at several Universities, though Harvard held first place. It was not in fact till 1929 that he was irresistibly drawn to French Canada: his studies of Quebec province and their great influence on the development of geography in Canada produced the second of his great life tasks. In the bibliography of his published works, 286 are listed from 1902 to 1957; he combined original research, especially in geomorphology and regional geography, with excellent textbooks which presented North America to the French in French (1933) and Europe to the Americans in English (1936), as well as a by-product of a journey to the East in *L'Asie occidental* (Géographie Universelle, 1929).

In common with most presentation volumes, the three dozen essays here presented in French or English cover a wide range. There is a small group on general topics, and another group on mountain geography; the majority are concerned directly or indirectly with Canada. The State and most of the larger Universities of Canada are represented among the authors: in a tribute to a founder of Canadian geography it is appropriate that the topics should reflect in the main the special interests of

the authors. In sum this is a volume that no geographer concerned particularly with Canada should neglect.

L. D. S.

A Descriptive Atlas of New Zealand. A. H. McLintock (ed.). 25·4× 30·5 cm. xxiv+112 pp. Wellington: Government Printer. 1959. 40s.

After waiting patiently from 1939 to 1953 for the appearance of the promised *Historical Atlas of New Zealand*, geographers were disappointed to learn that the project had been abandoned in favour of a less ambitious *Descriptive Atlas*. When this was published, in December, 1959, the first edition of 12,000 copies sold out in three days, and very few copies left New Zealand. A second printing is promised for late 1960, and it is to be hoped that overseas readers will have more opportunity to obtain copies. For the modest price asked, it is a remarkable bargain.

Accompanying its 48 map pages, the *Atlas* has 88 pages of text, with the result that the work presents a systematic geography of New Zealand. The maps deal with relief, geology, soils, several aspects of climate, pre-European vegetation, population distribution (1956 census), land utilization, land classification, manufacturing and communications. Most of these show the North and South Islands on facing pages, at a scale of 1 : 3,200,000. Then follow seven "double-spread" sections of a topographical map on a scale of 1 : 1,000,000. The break for the binding seriously detracts from their appearance and usefulness, while the seven shades (of green, yellow, brown and white) used for the layer colouring do less than justice to the rugged relief and steep slopes that are perhaps the most significant features of New Zealand's physical geography. The table of conventional signs for these maps is hidden away in the text section, "Notes on the Maps", which also have some useful information about the projections used in the *Atlas*.

Other maps include four showing the environs of the main cities on a scale of 1 : 100,000, two pages of "insets" of the island territories—the smaller ones at 1 : 350,000, the larger ones at 1 : 750,000—a double-spread of Antarctica, and three to show New Zealand's position in the world and in the Pacific. There are many black-and-white maps in the text, but space prevents the mention of more than two. On page 73, two dot maps of the Maori population of the North Island in 1926 and 1956 offend one of the tenets of cartography in adding place names in such numbers that the overall pattern of dots is ruined; while the map of the physical regions of New Zealand on page 80 is over twenty years old, would no longer be acceptable to most New Zealand geographers, and is nowhere mentioned in the text! A glaring factual error has crept into the text where Abel Tasman's map (page 6) is wrongly described as that of his pilot, Visscher. This and the Cook chart on the facing page deserve something better than half-tone reproduction.

Perhaps the highlight of the volume is the set of 25 full-page photographs, most of them aerial obliques, that were selected to illustrate the wealth of variety in the New Zealand landscape. These will repay careful study, which will be aided by the elaborate captions, collected together on eight of the introductory pages. The editor apologizes for the absence of views of the Northland, Waikato and Manawatu districts, to which one would add the Wairarapa and Nelson lowlands and the Kaikoura Mountains as regretted omissions.

The *Descriptive Atlas* has many of the ingredients of a good geography book—excellent maps, beautifully printed in pleasing colours, a wealth of factual information, and brilliant photographs—but it lacks the synthesis that would bind the parts into a whole; it could be described, not too unfairly, as a lavishly illustrated year book. It may not be too much to hope for, that the unexpected success of the *Descriptive Atlas* may encourage the New Zealand government to reconsider the scheme for an *Historical Atlas*.

J. S. D.

The World is Round. The Story of Man and Maps. F. Debenham, with an introduction by Bertrand Russell. 30·5×40·5 cm. 97 pp. London: Macdonald and Co. Ltd. (Publishers). 1959. 50s.

This is the first of the well-produced series of Rathbone Books to be devoted to geography. Ancient and modern maps are represented and the tools of the map-makers through the ages down to modern techniques in mapping under the surface of land and sea are discussed.

Two-thirds of the book (on the wide facing pages employed to give the largest scale possible) is given to photographs of global relief models; these include fifteen large hemispheres in altitude layer colours, and an equal number showing the continents and other major world regions in so-called "natural colouring" representing the characteristic vegetation as seen from the air. These colours are attractive, but often difficult to distinguish and identify; this is partly because of similarities in the range of shades used (e.g. the greens), of shadows resulting from the relief of the models and from global curvature, and partly because the colour key is printed only on one page.

A stimulating if somewhat expensive book for a school library where an actual coloured relief globe is not itself available. R. M. M.

The World around Us. Six essays based upon the Christmas lectures delivered at the Royal Institution 1958. Sir G. Sutton (editor). 14·5×22 cm. vi + 122 pp. London: English Universities Press Ltd. 1960. 16s.

These six essays, planned to follow the substance of lectures which marked the close of the IGY, are not intended as summaries of the work undertaken by geophysicists during those eighteen months, but as introductions to some of the problems of the earth scientist in general. They are, in order: The Ionosphere; The Earth's Magnetism; The Exploration of the Upper Atmosphere; The Lower Atmosphere and its Weather; The Sea and its Problems; The Antarctic. They most certainly deserve a place in the school library as a pleasant means of revision of some aspects of world physical geography, as well as—in the first three essays—an excellent survey of the margins of space. R. W. C.

Elements of Cartography. A. H. Robinson. 2nd edition. 18·5×25 cm. viii+343 pp. New York: John Wiley & Sons Ltd. London: Chapman & Hall Ltd. 1960. 70s.

Every geographer must have some knowledge of map-making for, without maps, the geographer can hardly make his distinctive contribution to the fund of learning. It is encouraging, therefore, to know that the amount of cartography taught in school, college and university geography courses is increasing steadily. The appearance of a second edition of Professor Robinson's already well-known work on cartography augurs well for this trend towards better map work.

The book provides a practical course in map-making considered from the geographer's point of view. Every care has been taken to keep the book at the same time authoritative and readily understandable. Typical of this approach is the section on projections, of which the author declares that his explanation "has been kept essentially non-mathematical". Other aspects of map-making are similarly discussed from a practical viewpoint and all problems of geographical cartography are thoroughly explored.

The content of the volume progresses systematically from the philosophy and history of cartography, through chapters dealing with projections, the assessment and processing of data, to map design, lettering and reproduction. In this revised and expanded presentation with fourteen chapters in place of ten the second edition surpasses the first. Greater attention is given to the difficulties of generalizing and symbolizing, of map projections and reproduction techniques. This edition also

contains a short section illustrating the methods of scribing used in the United States. A valuable feature of this essentially practical text is the inclusion of several useful tables as an appendix, including tables of five-figure logarithms with an explanation of their use, tables of powers of numbers, and tables for Lambert and stereographic projections. It is, however, unfortunate that some of the illustrations are smaller and some less well printed than those of the first edition.

The book is full of information and will be of value to teachers in senior classes wherever map work forms part of the syllabus. Moreover it further emphasizes the important contribution of North American geographers in the field of geographical cartography. May one hope, therefore, that shortly one of these practical volumes will appear without the qualification "elementary" which most carry at present? The general and elementary cartographic works have advanced the subject until it now awaits the appearance of works embracing advanced cartography.

I. A. G. K.

Salt Marshes and Salt Deserts of the World. Plant Science Monographs. V. J. Chapman. 16×25·5 cm. xvi+392 pp. New York: Interscience Publishing Inc. London: Leonard Hill (Books) Ltd. 1960. 95s.

This volume, in the Plant Science Monograph series, is the first attempt to give a complete picture of the salt marshes and salt deserts of the world.

There are, inevitably, inequalities of treatment since some important parts of the world have been little studied in this context and have contributed little to the literature. It is not surprising that British salt marshes should receive a much fuller treatment than those of Asia and the Arctic. When, however, Germany, the Low Countries and France, are dismissed in a mere six pages and the extensive marshes of the Gulf of Mexico receive little more than a passing reference, the inequalities of coverage are less easy to justify. The treatment of salt deserts seems almost casual. It would perhaps be better if the material on non-maritime saline areas were drawn together in a separate section. Despite these shortcomings, it must be said that Professor Chapman has made a most valuable contribution to ecological literature and one which is probably destined to be a standard work for many years to come.

Geography teachers will probably regard this book more as a work of reference than as a text-book. They will welcome particularly the well arranged bibliography, and they will appreciate the very clear and straightforward presentation of a sometimes difficult and intricate subject allied to their own. They will overlook the treatment of physiographical subjects, which is at times naïve, such as the equation of storms and recurved laterals (p. 22) and the too simple arithmetic on rates of accretion (p. 132).

The book is well produced and illustrated with a wealth of clear line diagrams and with photographs which are good enough to mask the difficulties of photography in such terrain.

C. K.

The Geography of Iron and Steel. N. J. G. Pounds. 12·5×19 cm. 192 pp. London: Hutchinson University Library. 1959. 10s. 6d.

This small, inexpensive book is a useful, pleasantly written addition to literature on the iron and steel industry. Of its eight chapters, the first three outline respectively "The Art and Science of Iron-working" (an historical introduction to iron technology), "The Ores of Iron", and "The Modern Iron and Steel Works". The remaining five chapters are brief accounts, each except the last prefaced by an historical introduction, of the iron and steel industries of the United Kingdom, Western Europe, North America, the Soviet Sphere, and the underdeveloped countries. There are ten maps and two diagrams.

The emphasis in presentation and approach are on the historical evolution of the industry, its techniques and its raw materials, rather than its present and past

location, its products and its markets. The approach adopted explicitly by the author denies the title of the book; for surely the location of the industry must be the primary object of study if the term geography is to be justified in the title. The paucity of maps and their insertion almost as parenthetic illustrations, instead of serving as the foundation for the text, may be deemed to confirm this criticism. Indeed, one has to wait until the back end-paper is reached to find the map, curiously contrived, of steel production and iron and steel works of the world.

As the author rightly states, "This is a very small book about a very large subject" —large, that is, mainly because so much, perhaps even too much, attention has been devoted to it in geographical and economic literature. He could not, therefore, hope to achieve more than a brief outline of the geography of iron and steel in the space allotted. He chooses instead, however, to place "emphasis on the history of the technology of iron and steel" (Foreword), and indeed writes more of history than geography. The book cannot for this reason be recommended as a basic text-book for the student of geography. It should not, however, be dismissed out of hand. The first three chapters are clear, readable summaries that may help many students to understand important aspects of the background to the geography of iron and steel. The remaining five chapters, though too meagre to be used as primary regional texts, may supplement and clarify more detailed studies. At 10s. 6d. this is to the geographer a worthwhile book on iron and steel, but it is not a "geography" of iron and steel.

E. M. R.

International Society for Educational Information. Bulletin No. 1. Understanding Japan. I.S.E.I. Inc. Tokyo. 1960. 32 pp. 4s. 5d. by International Money Order.

This modest but fascinating booklet should be read by all in Britain who teach the geography of Japan to children, or who write school text-books about that country.

The International Society for Educational Information has collected a number of text-books dealing with Japan which are used in the primary and secondary schools of 36 countries. From some of these books passages are quoted in italics under classified headings such as Earthquakes, Houses, Climate, and Population Distribution, to demonstrate ideas about Japan which are widely held in these countries. Each group of extracts is followed by comments and corrections, some of this enlightenment being in the guise of clear sketch-maps and photographs. This commentary has been edited by Professor R. Ishida, Department of Geography, Hitotsubashi University, Tokyo, and it effectively disposes of antiquated ideas about Japan which still persist in certain countries, from cormorants and cotton-mills to rice and rickshaws. In so doing, the booklet manages to present up-to-date information about economic developments in Japan.

A tactfully worded introduction observes that it is often difficult for a writer of text-books to present an accurate picture of a country remote from his own. The Society is anxious to provide correct information and expresses the hope that this Bulletin will assist teachers, writers and publishers to recognize the real Japan. It is equally concerned with similar mistakes which Japanese authors may have made in describing foreign countries, and welcomes friendly advice and suggestions on this matter.

Both in the tone of the Foreword and in the eminent good sense of its contents this Bulletin should achieve its aim and make a positive contribution towards the promotion of international understanding. One could wish that many other countries (including our own) would deal with school text-books in an equally enlightened manner to ensure that accurate and balanced pictures of foreign countries are presented to children in school.

Copies of the Bulletin may be obtained from International Society for Educational Information, Inc., (Kokusai Kyoiku Joho Centre) No. 22, 1-chome, Yotsuya, Shinjuku, Tokyo, Japan. L. J. J.

The Teaching of Geography and Adaptation of Syllabi to the Mental Level of Pupils. Preliminary Report of the International Geographical Union Commission on the Teaching of Geography. Montreal. 1960. 32 pp. Free. Printed by Denoyer–Geppert Company, 5235, Ravenswood Avenue, Chicago 40, Ill., U.S.A.

At the XVIIIth Congress of the I.G.U. at Rio de Janeiro in 1956 a Commission was established to consider what geography should be taught to pupils, having regard to their age and ability. During the last four years this theme has occupied the six members of the Commission, assisted by the contributions from educationists in several countries. This Preliminary Report was drawn up by M. René Clozier, of the French Ministry of Education, and circulated for consideration and comment before the Stockholm meeting this summer.

After preliminary observations on the purpose and method of geography in school, the Report stresses the need for geography teachers to employ the findings of psychologists in establishing the mental level of children, although it is admitted that these findings are not universally accepted and that there are differences of opinion concerning the relative importance of heredity and environment in determining intellectual levels. In an attempt to relate geography teaching to the mental age of pupils an analysis was made of syllabi and teaching methods employed in various parts of the world. It is curious that although the Report outlines the syllabus followed in seventeen different countries, including Thai-land and Yugoslavia, Great Britain is omitted. However, certain elements appear common to many of the samples, and tentative findings are drawn.

Part III, dealing with solutions to the problem, is admittedly brief and inconclusive, for the status of geography varies widely from the schools of one country to another. The Report ends with a select bibliography of books and manuscript papers relating to the theme of the Commission, and gives abstracts of the papers presented to the Congress at Stockholm in August 1960. L. J. J.

Report on the Work in Geography, with Reproductions of Candidates' Answers. University of Cambridge Local Examinations Syndicate. General Certificate of Education, Ordinary Level. Cambridge. 1958. 36 pp. 2s.

Teachers who prepare candidates for the General Certificate of Education are grimly interested in the annual reports of the examiners which are published some time after the results have been announced. As a guide to better teaching, however, these reports have their limitations, for they tend to be too brief and too negative in character; they expose common errors of omission and commission but fail to demonstrate what kind of positive achievement merits a pass.

This Report on the work of Ordinary Level Geography candidates for the Cambridge Local Examinations held in July 1956 is more detailed and more constructive in its analysis of the entries, for in addition to giving general comments on each question, examples are printed of actual answers as written or drawn by real (but mercifully anonymous) candidates, complete with all the original sins of spelling, style and shape. Each answer is critically dissected and supplied, for full measure, with the examiners' estimate of its worth, e.g. "this is a good pass" or "the standard of this answer is slightly below pass level". Such frankness is rare but refreshing.

All the questions are printed from the two papers which deal respectively with General and Regional geography, although it was not practicable to reproduce the O.S. map extract, the photographs, and some of the maps. After the analysis of

each Paper there is a summary of the principal general weaknesses which have been observed in scripts over a period of several years.

The usefulness of this compilation is not confined to teachers who prepare candidates for this particular examination, although it would be a good idea if other Examining Boards could produce occasionally a more detailed Report resembling this one from the Cambridge Syndicate. L. J. J.

BOOKS AND PUBLICATIONS RECEIVED

The Langdales: A Lakeland Parish. J. C. Dewdney, S. A. Taylor and K. G. Wardhaugh. 23 pp. Occasional Papers series no. 3 (1959). 2s. 6d.

The Mediaeval Land Surveys of County Durham. P. Dickinson and W. B. Fisher. 15 pp. Research Papers series no. 2 (1959). Durham Colleges in the University of Durham, Department of Geography, Science Laboratories, South Road, Durham.

Leicestershire. An Illustrated Essay on the History of the Landscape. W. G. Hoskins. 138 pp. London: Hodder and Stoughton. 1957. 25s.

Sheffield and Its Region. A Scientific and Historical Survey. D. L. Linton (ed.). 334 pp. Sheffield: Local Executive Committee, British Association for the Advancement of Science. 1956. 30s.

The Cistercian Settlement and the English Royal Forests. R. A. Donkin. (Reprint) *Cîteaux*, vol. xi, 1960, Cistercian Abbey, Westmalle, Belgium. Dr. Donkin's article on site changes of mediaeval Cistercian monasteries in England and Wales appeared in *Geography*, vol. xliv, November 1959.

A Description of Ordnance Maps of Northern Ireland. Govt. of Northern Ireland Ordnance Survey office, Armagh House, Ormeau Avenue, Belfast. 1959. 2s. 6d.

The Colonies. A guide to material and information services available to schools and to the public. New edition. Central Office of Information. London: H.M.S.O. 1959. Free. *Britain's Overseas Territories.* C.O.I. for the Colonial Office. London: H.M.S.O. 1959. 1s. 6d.

The Port Traffic of Oslofjord Region. T. Ouren. Publications of the Norwegian School of Economics and Business Administration. Geographical Series no. 6. 168 pp. Bergen: J. W. Eides. 1958. 25 kr.

Reports of the Geographical Field Group. *The Island of Elba*: report of field work carried out during April 1958. 113 pp. *The Alleghe Area, Italian Dolomites*, August 1958. 72 pp. Cyclostyled. Nottingham: Secretary, Geographical Field Group, Department of Geography, University of Nottingham. 1959. 6s. each plus postage.

Proud Fortress. The Fighting Story of Gibraltar. A. Andrews. 220 pp. London: Evans Bros. 1958. 18s.

The Story of Islam. S. F. Mahmud. 354 pp. London: Oxford University Press. 1959. 12s. 6d.

The Middle East; Then and Now. W. B. Fisher. Inaugural lecture, February 1958, University of Durham, Durham Colleges. 23 pp. 1958.

The Pattern of Land Tenure Reform in East Asia after World War II. S. Klein. 260 pp. New York: Bookman Associates Inc. 1958. $10.

Proceedings of the 3rd Regional Technical Conference on Water Resources Development in Asia and the Far East. 173 pp. United Nations Economic Commission for Asia and the Far East. Flood Control series no. 13. Bangkok: United Nations. 1958. 12s. 6d. (Obtainable at H.M.S.O.)

A Practical Geography of Malaya. 1959. 5s. 6d. *A Practical Geography of Singapore.* 1957. 3s. 6d. A. J. F. West and J. Rose. London: University of London Press. Practical workbooks for children, upper junior or lower secondary level.

The Development of Hong Kong and Kowloon as Told in Maps. T. R. Tregear and L. Berry. 31 pp. Hong Kong University Press. London: Macmillan and Co. 1959. 10s.

Japanese Geography: A Guide to Japanese Reference and Research Materials. R. B. Hall and Toshio Noh. 128 pp. University of Michigan Center for Japanese Studies, Bibliographical Series no. 6. Ann Arbor: University of Michigan Press. London: Michigan University Press; Cumberlege. (Oxford University Press.) 1956. 40s.

Bankers and Pashas. D. S. Landes. xvi+354 pp. London: Heinemann. 1958. 30s.

Egypt in the Sudan 1820–1881. R. Hill. R.I.I.A. Middle Eastern Monographs. xii+188 pp. London: Oxford University Press. 1959. 25s.

A Bibliography of Libya. R. W. Hill. 100 pp. Research Papers series no. 1 (1959). Durham Colleges in the University of Durham, Department of Geography, Science Laboratories, South Road, Durham. 12s. 6d. (13s. 6d. overseas).

East African Explorers. Selected and introduced by C. Richards and J. Place. The World's Classics no. 572, double volume. 356 pp. London: Oxford University Press. 1960. 8s. 6d.

The Prehistory of Southern Africa. J. D. Clark. Pelican Books A 458. 341 pp. Harmondsworth: Penguin Books. 1959. 6s.

Canada: Department of Mines and Technical Surveys, Geographical Branch. Bibliographical series. No. 13, revised edn. Canadian Urban Geography. 1957. 50 cents. No. 20, Selected bibliography on Canadian permafrost (annotations and abstracts). F. A. Cook. 1958. 25 cents. No. 22, Bibliography of periodical literature on Canadian geography 1930–1955. Part 1, Canada, general. Part 2, Atlantic provinces. Part 3, Quebec and Ontario. Part 4, Prairie Provinces. All 1959 and 50 cents each. No. 23. Selected bibliography of Canadian Geography with imprint 1957. 1959. 50 cents.

The Indians of Quetico (Ontario). E. S. Coatsworth. 58 pp. Univ. Toronto Press. London: Oxford Univ. Press. 1957. 14s.

Sons of the Shaking Earth. The People of Mexico and Guatemala, their Land, History and Cultures. E. R. Wolf. 303 pp. Univ. Chicago Press. London: Cambridge Univ. Press. 1960. 40s.

South America. An Economic and Regional Geography. E. W. Shanahan. 318 pp. 10th edn. 1959. London: Methuen. 25s. In this edition, fully revised in the light of recent developments, relevant statistical data have been brought up to date to 1955–56. New maps have been introduced and some place names (Brazilian) now in use have been substituted for older forms.

Incas and other Men. Travels in the Andes. G. Woodcock. 268 pp. London: Faber and Faber. 1959. 25s.

Land Utilization in Australia. S. Wadham, R. K. Wilson and J. Wood. Melbourne. 344 pp. Melbourne Univ. Press. London: Cambridge Univ. Press. 3rd edn. revised, 1957. 40s.

Maps of Canterbury and the West Coast. A Selected Bibliography. Canterbury Branch of the New Zealand Geographical Society. Mimeographed. 49 pp. Christchurch. 1958.

Return to the Islands. Junior Edition. A. Grimble. 154 pp. Abridged; illustrated. London: John Murray. 1960. 7s. 6d.

Antarctica. P. R. Heaton. Rockliff New Project Illustrated Geography. 75 pp. London: Barrie and Rockliff. 1959. 8s. 6d. Written for the secondary modern school.

Antarctica Today and Tomorrow. G. C. L. Bertram. 28 pp. London: Cambridge Univ. Press. Dunedin: University of Otago. 1958. 5s.

Selected Maps amd Charts of Antarctica. An annotated list of maps of the South Polar Regions published since 1945. Compiled by R. W. Stephenson. 193 pp. Washington, D.C.: Map Division, Reference Department, Library of Congress. 1959. $1.50.

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Television for schools

Geography: 'The British Isles'

This series of school television programmes, produced by Associated-Rediffusion, commenced with the 1960 Autumn Term on September 19th and will extend over the three terms in the school year. 'The British Isles' is planned for children in the 12-14 age group. As it is not possible to cover every region over three terms, it is intended to contrast those illustrating the principal geographical features in these islands. The academic consultant for these geography programmes is Mr. William Middlebrook, M.A., F.R.G.S., Senior Lecturer in Geography, Nottingham Training College.

Most of the areas are covered in two complementary programmes. One consists of specially shot film, giving a broad picture of the area, the other is a studio programme in which the features surveyed in the film are explored in detail with the help of models, diagrams and still photographs. The work and life of the people are shown as a response to their environment and recent developments are taken into account.

As neither the films nor the live programmes can hope to examine in detail every point likely to arise, Teachers' Notes have been prepared to indicate the scope of the programmes, to provide a summary of the main geographical features in the area concerned, to suggest lines of preparation and further study, and give a general bibliography.

Television for schools programmes, based on over three years' experience of school television, are intended to supplement the teacher's own work by using the resources of television to arouse the children's interest and show them aspects of school subjects which cannot be easily shown in the classroom. Teachers' Notes are supplied to over 1,500 registered schools to help with preparation and follow-up.

These programmes are available in the areas served by Associated-Rediffusion (London), ATV (Midlands), STV (Scotland), TWW (S. Wales and the West of England), Southern Television, TTT (North East), Anglia Television (East Anglia), and Ulster Television (Northern Ireland).

Autumn Term, 1960.
September 19th to December 9th.

A LAND IN THE MAKING	
THE HIGHLANDS OF SCOTLAND (produced by Scottish Television)	In two parts
THE CENTRAL LOWLANDS (produced by Scottish Television)	In two parts
ULSTER	
SOUTH WALES	In two parts
THE PENNINES	In two parts

Spring Term, 1961.
January 16th to March 24th.

	Wednesday 2.45 p.m.	Thursday 3.25 p.m.
SHEFFIELD AND THE PENNINES		
Part I	18th	19th Jan.
Part II	25th	26th Jan.
NORTHUMBRIA	1st	2nd Feb.
THE MIDLANDS		
Part I	8th	9th Feb.
(Half-term repeat)	15th	16th Feb.
Part II	22nd	23rd Feb.
(Half-term repeat)	1st	2nd Mar.
THE SOUTH WEST	8th	9th Mar.
EAST ANGLIA	15th	16th Mar.
THE FENS	22nd	23rd Mar.

Summer Term, 1961.
April 24th to June 16th.

THE WEALD	In two parts
THE LONDON BASIN	In two parts
COMMUNICATIONS	
SUMMING UP	

Fuller information about these and other 1960/61 programmes may be obtained from the Schools Information Office:—

ASSOCIATED-REDIFFUSION

London's Television, Monday to Friday

Television House, Kingsway, London, W.C.2. HOLborn 7888.

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The authors alone are responsible for the opinions expressed in their articles.

Manuscripts are invited for consideration by the Editorial Board for publication in *Geography*; a leaflet of information for contributors can be obtained from the Honorary Editor. Articles of appropriate length are also invited for "This Changing World". Manuscripts submitted for publication and books for review should be addressed to the Honorary Editor, The Geographical Association, c/o The Park Branch Library, Duke Street, Sheffield 2.

Inquiries for advertisement space in *Geography* should be addressed to the Assistant Editor, The Geographical Association, c/o The Park Branch Library, Duke Street, Sheffield 2.